

Improving Packaging Assignment on a fashion multi-partner e-commerce platform

Catarina Matos Fernandes da Hora Marques

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Supervisor: Prof. Bernardo Sobrinho Simões de Almada Lobo



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Abstract

As a result of globalization and constant growth of luxury e-commerce, new challenges emerged related to increasing costs and difficulties fulfilling orders with the quality level required by a demanding customer base. In a marketplace platform, these operational challenges are even harder to solve, due to the lack of control that exists in the order processing process of each one of the partners that sell through the website. With new players entering the market every year and with the increasing complexity of more partners joining, it is fundamental to have a flawless, competitive and uniform shopping experience.

This dissertation will focus on one of the steps that occur in every order: the selection of the adequate packaging for each specific parcel. The amount of air shipped every year in empty box space is just a waste of money and resources that is negatively perceived by many customers. This effect is particularly notorious during peak season, partners neglect the packaging choice even more, due the lack of awareness of the negative impact that sending a bigger box has.

During 2018, Farfetch discovered an opportunity to reduce shipping costs, while increasing customer experience and reducing the ecological footprint, by giving a recommendation of which box is more adequate for each order. A new process to keep track of the boxes that are actually sent was put in place and an incentive was launched to encourage partners to start using the smallest box possible. To monitor the progress a new metric was established -Packaging Accuracy- which reflects the percentage of boxes sent correctly. However, results were not as positive as expected, after an initial lift of over 4% in Packaging Accuracy it returned quickly to beginning values.

This project was created with the objective to understand what are the main reasons for the partners not to follow the recommendation provided. The goals are to describe the actual problem that is being faced, to detect main causes of error and to delineate lines of action to solve them, going beyond the monetary incentive, which does not commit partners in the long term. During this work two main methodologies were used: Design Thinking Double Diamond and Continuous Improvement tools. With the combination of both frameworks, it was possible to create a more open and disruptive environment, to draw solutions and make suggestions while still grounding the initiatives with savings and prioritizing them rationally. For all the different opportunities that were identified, they can be clustered in two main consequences: 1) Farfetch packaging recommendations given are wrong, which resulted in a loss of credibility in the suggestion; 2) Partners are not engaged with the cause; either the partners' employees do not see the recommendations or they are not provided with any guidelines for how to select the most adequate package.

After an in-depth analysis, an action plan was created that would enable Farfetch to reach the target of 85% of the orders being sent in the correct box, starting from a baseline of 74%. The framework used allowed to understand the main weaknesses of the process, the reasons why previous initiatives were not successful, provide guidelines to correct them and design an implementation plan that will Farfetch to unfold this huge improvement potential. Even though, the implementation is still ongoing, some savings could already be measured.

Resumo

Como resultado da globalização e do crescimento do comércio eletrónico de luxo, surgiram novos problemas relacionados com o aumento de custos e com as dificuldades em responder às encomendas com a qualidade mínima exigida pelos clientes. Num negócio de *marketplace*, esses desafios operacionais são ainda mais complicados de resolver devido à falta de controlo que existe no processamento de pedidos de cada parceiro que vende através do *site*. Com novos concorrentes a entrar no mercado todos os anos e devido à crescente complexidade de ter mais parceiros associados, é fundamental haver uma preocupação em providenciar uma experiência de compra perfeita, que seja competitiva e uniforme.

Esta dissertação foca-se numa das etapas que ocorre em cada encomenda: a escolha da embalagem. A quantidade de ar enviada todos os anos em caixa vazia é um desperdício de dinheiro e de recursos, que é percecionada negativamente por muitos clientes. Este facto agrava-se particularmente durante a época alta de vendas, em que os parceiros negligenciam ainda mais a escolha da melhor embalagem possível, por falta de consciência do seu impacto negativo.

Em 2018, essa preocupação com a decisão da embalagem correta foi levantada pela primeira vez. A Farfetch descobriu uma oportunidade de reduzir os custos de envio, enquanto melhora a experiência do cliente e reduz a pegada ecológica da empresa, tornando-se num apelativo caso de estudo. Um novo processo para controlar o tamanho das caixas que são enviadas foi implementado e um incentivo financeiro foi lançado para estimular os parceiros a começar a usar a menor caixa possível. Para monitorar o progresso do projeto uma nova métrica foi criada para refletir a percentagem de caixas que foram enviadas corretamente. No entanto, os resultados não foram tão positivos quanto o esperado. Depois de um crescimento inicial de 4% na precisão de acondicionamento à embalagem, os valores regressaram ao estado inicial.

Este projeto foi criado com o objetivo de clarificar quais foram as principais causas para os parceiros não seguirem a recomendação, descrever o problema, e resolvê-lo, para além do incentivo monetário, que não motiva os parceiros a longo prazo. Durante este trabalho foram utilizadas duas metodologias: ferramentas de *Design Thinking* e de Melhoria Contínua. Com a combinação dos dois *frameworks*, foi possível encorajar o pensamento disruptivo para desenhar soluções, enquanto justificamos as iniciativas com poupanças e estabelecemos prioridades. Dos diferentes problemas identificados, podem ser agrupados de duas formas: 1) a recomendação da Farfetch estar errada, resultando numa perda de credibilidade na sugestão; 2) os parceiros não estarem comprometidos; porque os colaboradores não veem a recomendação ou porque não lhes é fornecida nenhuma diretriz sobre como selecionar a embalagem mais adequada.

Após uma análise detalhada, foi criado um plano de ação que permite à Farfetch atingir o objetivo: de 85% dos pedidos enviados na caixa correta. A estrutura utilizada permitiu compreender as principais fragilidades do processo, as razões pelas quais as iniciativas anteriores não tiveram o resultado desejado, fornecer orientações para melhorar o processo e planear o caminho para a Farfetch alcançar este enorme potencial de melhoria.

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Because I'm extremely grateful for all the help and all the people involved that allowed me to become the Industrial Management Engineer that I am today, I want to guarantee that you feel appreciated and aware of the positive impact you had in my life. I can never thank you enough.

"Do what has never been done before"

Neil deGrasse Tyson

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Acronyms and Symbols

API	Application Programming Interface
AWB	Air WayBill
AW	Autumn Winter
BO	Boutique Order
CI	Continuous Improvement
FF	Farfetch
FPR	False Positive Rate
GTV	Gross Transaction Value
IPO	Initial Public Offering
KPI	Key Performance Indicator
ML	Machine Learning
NPS	Net Promoter Score
OC	Order Contribution
PA	Packaging Accuracy
PC	Production Center
PO	Portal Order
POV	Point-of-View
ROC	Receiver Operating Characteristic
RoW	Rest of the World
SKU	Stock Keeping Unit
SLA	Service Level Agreement
3PL	Third Partner Logistics
TPR	True Positive Rate
US	United States of America
YoY	Year-over-Year

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Chapter 1

Introduction

In an age of fast changing trends, luxury companies have started to focus on new and younger segments of the population, namely Millennials ¹ and Gen Z ², that are clearly the customers of the future. These are technological savvy generations who look forward to a worldwide integrated digital access to information, by means of an increasing use of social media to engage and communicate with brands (Bersin et al., 2017). To guarantee their survival, luxury retailers have to readjust their business model and to be able to respond to these new needs and trends. Nevertheless, according to Armstrong (2017), it is very expensive to establish an online business, especially for non-global stores that do not have the same ease of scalability and knowledge of online marketing.

Based on the ancient model of a market, where several merchants gather together to facilitate the trading with the population, online marketplaces appeared as electronic platforms (website and/or app) that gather and facilitate shopping exchanges from many different sources (Kestenbaum, 2017). Marketplaces provide the opportunity to sell online without any major investments, making them very appealing for small sellers that can expand the pool of customers and reach new generations in detriment of some margin of sales. The main competitive advantages of a marketplace are to reduce the customer search effort, due to the vast product catalogue, and to not hold any stock, eliminating the risk of carrying any unwanted product (Hirsch, 2018).

In every e-commerce business, one of the greater opportunities to reduce costs is related to decreasing shipping costs, which are dependent on distances and on packaging. Currently, 40% of an order's cost is associated with transportation costs, which can be reduced if smaller packages are used to pack the items. Additionally, other opportunities were found, by having more compact boxes being sent, the customer's unboxing experience can be increased and the carbon footprint reduced.

The present thesis, integrated in the Strategic Planning team of Farfetch, emerged as a need to bridge the discrepancies that exist between what is the most adequate box for each item and the one that is sent to the final client. Therefore, to explore this opportunity the main focal points will

¹People that were born between 1980 and 1995

²People that were born between 1995 and 2010

be around: how to understand what is the appropriate box for each item; and how to encourage partners to follow what is being requested during the packaging selection. In the following, we first present Farfetch in Section 1.1, then the different motivations that led to this project creation in Section 1.2, after the project description and objectives will be detailed in Section 1.3, later the methodology used throughout the work will be described in Section 1.4, and lastly the dissertation structure will be explained in Section 1.5.

1.1 Farfetch Presentation

Farfetch is a company with a global platform that provides services to the luxury fashion segment, according to its founder José Neves. In addition to the marketplace with over 700 partners in 2018, for which it is more well known for, Farfetch is currently developing new services that will allow to provide a more personalised and luxurious experience to the customer by connecting the physical stores with technology (Marques and Silva, 2019).

Founded in 2008, Farfetch began as a platform to help local high-end boutiques to reach broader audiences and later evolved as a tool, through which, brands like Gucci could sell directly. In 2018, with over 4 000 employees in 10 different countries, the company exceeded \$1.2 billion of sales, while growing 55% when compared to the previous year. Another recent accomplishment was the launch of its IPO³ in 2018 in the New York stock market, which valued the company in \$6.2 billion, taking into account employee dilution (Hirsch, 2018).

Farfetch website's business model consists in linking the orders to the physical inventories of the different stores' stock points. It is a customer-centric platform that takes care of delivery logistics, customer service and digital production, in order to guarantee a luxury and unique buying experience according to Tauriello et al. (2017). Farfetch's major responsibilities focus upon the coordination of all the the information flows between partners (boutiques and brands that sell through the website), carriers and final customers. In simpler words, Farfetch is an e-commerce platform that sells luxury fashion from different partners making it a marketplace by definition.

After reaching a unicorn valuation ⁴ in 2018 (Moules, 2016) the start-up's success was undeniable and can be explained by a combination of different factors. As Achille et al. (2018) concluded, around 80% of luxury sales today are "digitally influenced" and there is the expectation that online sales which are currently around 10% will grow to 20 or 30% in the next decade, which explains the fast growth. Another advantage created by this model is that the website has to offer a tremendously higher number of SKUs ⁵ when compared with competitors which is very appealing for invertors. As we can observe in Figure 1.1, Farfetch also stands out in the the cumulative shelf value that it offers to clients, due to the great number of products sold and the high average price each one has.

³Public offering of shares of a private corporation

⁴Term used in the finance world to call a private startup company valued over one billion dollars.

⁵Unit of distinct type of items for sale

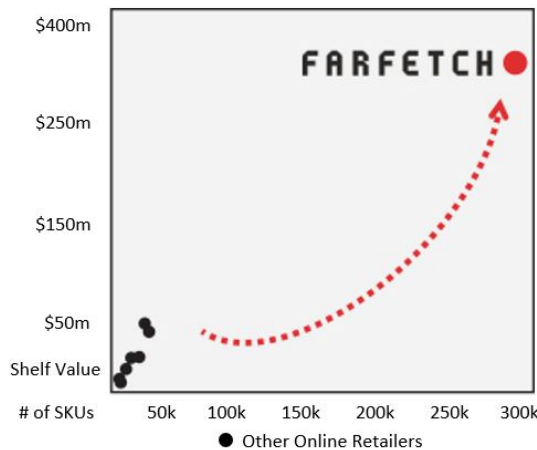


Figure 1.1: Number of SKUs compared with other Online Retailers; Source: Jaffe et al.

1.2 Motivation of the project

After understanding the context in which this project is inserted in, it is relevant to understand what were the main drivers to sponsor it. The Packaging Allocation project was created in the sequence of identifying an opportunity to better adjust Farfetch's packaging and reduce the quantity of air transported. Based on historical data savings, if we assume that 60% of partners⁶ follow Farfetch recommendations on 85% of the transactions they receive, by the end of 2019, the company has the opportunity to save up to \$2.5M in shipping costs while increasing customer experience and being more environmentally sustainable. According to Wilson (2019), millennials are mindful about wasteful packaging which corroborates the idea that adjusting the package to the item it carries inside will not only impact the transportation costs but will also increase the customer's satisfaction when opening their order. The unboxing experience is also very relevant for customer retention and promotion of the brand, as it is the first point of physical contact with Farfetch, creating an additional incentive to invest in the project.

Summarily, according to Henriques and Richardson (2004), this project relies upon the 3 pillars of corporate sustainability: environmental, with the concern to reduce the carbon footprint that the company currently has; economic, by reducing the shipping costs' structure; and social, by taking the customer experience and satisfaction as a concern.

1.3 Project Description & Objectives

The packaging selection concern had already been raised in 2018, when a packaging recommendation started being showed for every order, a new packaging control system was installed, and a monetary incentive was implemented to reward partners that tried to use the smallest box

⁶Boutiques and brands that sell through the Farfetch website

(processes will be further explained in Section 3.2.3, 3.2.4 and 3.2.5, respectively). This packaging suggestion can be given by Farfetch when the product is being shipped and uploaded online or by an algorithm that evaluates the box's sizes in which the product was historically sent.

Unfortunately, inherent with Farfetch's business model, there is a high lack of control in the different processes that each partner has. Consequently, to obtain the expected results extra efforts have to be made in order to implement any significant changes in the partners' behaviour. After identifying the different opportunities that still exist regarding this matter, combined with the increased feedback that Farfetch was receiving, there was a strong reasoning to start this project and reinforcing the importance of the subject. Illustrated in Figure 1.2 are some examples of wrong packaging that were sent to Farfetch's clients.



Figure 1.2: Wrong Packaging examples

This project was proposed by the Operations Strategy department in which Strategic Planning belongs to. This team can act across all the Operations departments ⁷ of the company and is mostly composed by project managers and business analysts that have the appropriate skills to conduct this type of sporadic initiatives. In Figure 1.3, it is possible to observe the different responsibilities that the Operations' division is currently accountable for. The teams that will be directly involved in this project are: Delivery Development, Supply & Retail Operations, Process Engineering and Partner Success. The Delivery Development team is responsible for every decision regarding what and how the products are delivered to the customers; Supply & Retail Operations deals with the packaging suppliers, boxes orders and communicates with the third party logistics (3PL), which is responsible to supply the partners with all the packaging components; Process Engineering is accountable for the production process performance and architecture; and Partner Success is in charge of the communications with partners.

In order to increase the Packaging Allocation and obtain positive impacts in all the three pillars, there were two main objectives to be pursued during this project:

- **Raise the quality of Farfetch's recommendation:** respond to the different challenges that measuring the most appropriate box has and increase the scope of orders evaluated. By adding more credibility to the suggestion, Farfetch will be able to be more rigorous with the targets required, as well as, implement monetary penalizations to offenders;

⁷Departments accountable for planning, managing, coordinating and controlling all daily activities related to the services provided (Slack et al.)

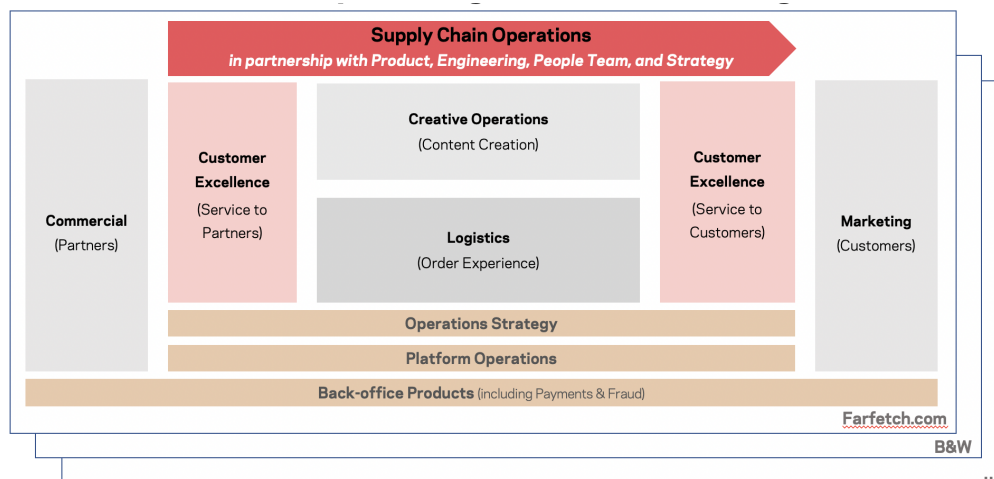


Figure 1.3: Operations department responsibilities at Farfetch

- **Influence partners' behaviour:** create awareness about the positive effect that choosing the smallest box possible has in clients' experience and environmental impact. Consequently, the ultimate goal is to increase the Packaging Accuracy with new initiatives and reach an overall average of 85%. This will be the main KPI that will be used as measure of success throughout the project, whose calculation will be further explained in Section 3.2.4.

The main deliverable that should be withdrawn from this project is a list of actions that will make the Packaging Accuracy increase, as well as reduce the delivery costs. The implementation plan should be composed of different stages, where some will have an immediate execution focused on improving the already existing process. Others to be worked upon in the future, due to its disruptive nature they will not be able to be deployed during the time frame of this project.

1.4 Methodology

The work performed during this project follows two combined methodologies the "Double-Diamond" methodology used in Design Thinking processes and Continuous Improvement tools. The first one is composed of different stages with the purpose to wide and restrict the thinking process involved, being extremely effective when trying to design new ideas and solutions. It is a methodological approach very useful to conduct a design process and to create concrete deliverables of a creative process.

This method is divided in four stages: discover, when the problem is explored and causes that could create it are identified with interviews to the different stakeholders involved; define, where a more precise problem statement is established, the characterization of the main causes of error is made and a deeper understanding of the problem is provided; develop, constituted by brainstorm sessions with the goal of finding solutions to the faults' causes presented before; and deliver, where hypothesis are tested and a path to reach the solution is established. (Bicheno and Holweg, 2016) The second methodology of continuous improvement tools is composed by different tools that

will be used to help corroborate the new initiatives that want to be implemented, such as process mapping, control charts, ishikawa diagram, among others.

1.5 Thesis structure

This dissertation is organised in six chapters that will be outlined as follows:

Chapter 1: introduces the present essay, which includes a presentation of the company, its business model and its environment. A short description of the project that will be developed, its scope, motivation and objectives. Finally a short presentation of the methodology that will be followed in order to achieve the goals proposed.

Chapter 2: provides the theoretical background that will be the foundation to scientifically justify the decisions and assumptions that will be made throughout the different steps of the thesis. This chapter will start with a small description of the luxury environment where Farfetch operates, followed by a description of the importance of the packaging on the overall customer experience, an analysis on the impact that e-commerce has environmentally; the challenges faced by a marketplace to try to implement any changes and lastly techniques on how to structure the work and, finally, a process to generate ideas and to reach a solution complemented with continuous improvement techniques.

Chapter 3: describes the packaging related processes and their current performance together with a critical analysis of the AS-IS state and its limitations.

Chapter 4: presents the different stages of a "Design Thinking" process starting by identifying the causes for the different errors that occur within the entire Farfetch packaging environment, followed by a more precise definition of the problem and finishing with the presentation of different initiatives and its prioritization.

Chapter 5: concretizes the implementation plan with the different actions and timelines for the different initiatives. Presentation of some preliminary results from immediate changes which demonstrated positive impacts.

Chapter 6: concludes the dissertation with a summary of the work. The main improvements achieved, the expectations of accomplishments for the future and a set of other ideas that could be examined in forthcoming projects.

Chapter 2

Literature Review

This section contextualizes the most important concepts that will be approached during the project and it will be divided in three distinct parts. The first, gives a general overview on the company's business and customer environment with a description of the luxury and its peculiarities. The second, describes some current market trends that affect the project's focus, such as the importance of packaging in the customer experience and the new environmental concerns. Last, the main methodologies that will be applied throughout this project to frame and guide the workflow of the project.

2.1 Business Environment

In the very last decades, internet had a very big impact in many social behaviours affecting the way of doing business. As a matter of fact, a notable change has occurred in the relationship between companies and consumers. Consumers have gained more leverage than ever before, due to the gigantic amount of data that has become accessible through the web. This empowerment can be summarised into three main points: instant information; lower switching costs; higher expectations (Tauriello et al., 2017). With that in mind, understanding the environment where Farfetch is operating and how it can fulfill its segments' needs is extremely important to justify the decisions taken.

Historically, the luxury ecosystem has been associated with different conceptual dimension, such as excessive consumerism, conspicuousness, uniqueness, among others (Arthi and Mathi, 2014). However, it still remains as a complicated term to empirically define due to a strong element of human involvement, which makes its perception dependent on the individual as well as its geography (Robson et al., 2006). Mainly focused in dragging attention and gain social recognition according to Keller (2009), a luxury position requires actions that will result in a premium image, such as premium pricing strategy, attention to logos, symbols, packaging and consistent linking the brand to prestigious communication mediums and events.

Consultants and economists prefer to define luxury brands as those whose price and quality ratios are the highest of the market; that is, they are significantly more expensive than the products with similar tangible features (Vigneron and Johnson, 2004).

2.1.1 Luxury e-commerce

Compared to other industries, the luxury e-commerce started much later to be exploited, whether to sell or not online represented a multi-faceted business question. In luxury, besides the usual complexity of coordinating multiple channels, an additional concern applies: selling luxury goods online may erode the fragile perception of scarcity and thus brand appeal. The apparent mismatch between a luxury brand's concept of exclusiveness and the mass reach of Internet is often referred to as "Internet dilemma", according to Kluge and Fassnacht (2013).

However, for the third year straight, the top sales growth investment priority remains in developing omnichannel capabilities. This reveals that executives have finally come to terms with the fact that the industry is digitising (Amed et al., 2018). In contrast to mass manufacturers, luxury goods manufacturers limit the accessibility of their goods in terms of a selective distribution, high-end prices, and limited production in order to preserve brand desirability. (Keller, 2009).

Over the next decade, D'Arpizio et al. (2017) expect that the luxury market's distribution footprint will evolve significantly. Physical stores will still account for 75% of purchases, as we can see in Figure 2.1, but the mix of store formats will shift. Stores will start having more interactive options and create more personalized experiences with the help of technology (Achille et al., 2018).

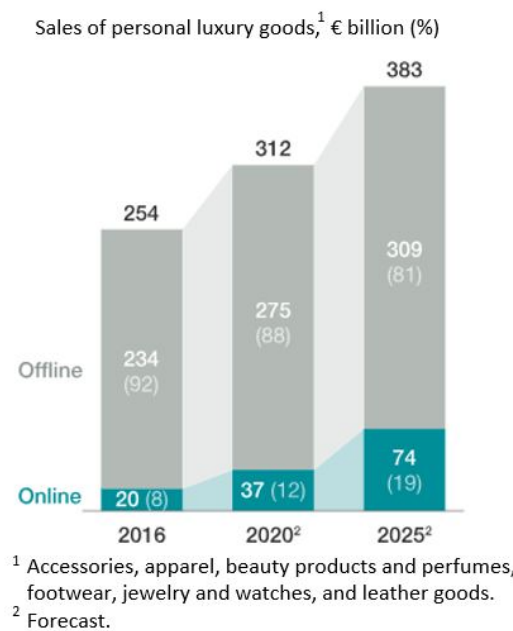


Figure 2.1: Sales of Personal Luxury Goods. Source: Achille et al. (2018)

2.1.2 Luxury customer

After understanding the products and the new channel opportunities, we should focus on the customers expectations when experiencing such a service, especially when the customer is the basis of the business model. Ünsalan and Tarihi (2016) believe that luxury shopping is not related to the need of a certain product, but to an irrational dimension. Hence, brands need to produce a high-impact experience that can generate an emotional response from the customers (Tauriello et al., 2017). Moreover, Okonkwo-Pézard (2017) describes this group of consumers with the following characteristics: restless; empowered; fashion-savvy; highly demanding; convenience driven; cash-rich and time-poor; media and brand saturated; individualistic and independent; informed, knowledgeable and educated; financially, socially and environmentally aware; and, finally, less attuned to brand loyalty and more to brand-hopping. "The global consumer of today is online and connected." declare Patrick and Prokopec (2015), "This is where they are looking and they are expecting brands to be there".

Taking into account all these dimensions, there are a few key concerns that should be considered, such as an intuitive navigation website that allows fast buying. This can be obtained by creating an overall online experience that is coherent with the brand message and, above all, credible.

2.1.3 Market Place

After exploring the different requirements expected from the luxury environment, it is relevant to understand the responsibilities that Farfetch's business model demand. According to Marques and Silva (2019), José Neves (its founder) believes that Farfetch is not exactly an accurate global marketplace since it takes into consideration the customer experience which is something that so far never existed in such platforms. However, as it is a multi-player model, it is important to understand how e-marketplaces create value and where are the chances of crafting a strategy that will lead to a sustainable and competitive advantage.

The core service of e-marketplaces is to provide a central market space, where e-commerce can be conducted. However, although e-commerce is a very important aspect of e-marketplaces, they are not limited to it (Brunn, 2002). Figure 2.2, depicts the market place business model, as well as examples of other services that the platform can provide for both partners and customers.



Figure 2.2: The e-Marketplace Business Model; Source: Brunn (2002)

2.2 Market Trends

Once the environment was established, it is fundamental to understand which current trends are relevant and can affect the direction of the project. According to Bersin et al. (2017), being on top of the current trends is advantageous for companies to not be surprised by a competitor and helps creating useful and meaningful content for the project.

2.2.1 Packaging Importance

As mentioned by Wilson (2019) in an e-commerce business, the box becomes the "face of the company" since it is the only moment where a brand or company can physically expose itself to the customer. For e-commerce retailers who want to create a lasting impression to their customers, packaging meaning goes beyond just protection. This connection, called the unboxing experience, has become a marketing tool that businesses can use to make clients happier. According to Bayston (2016), boxes allow brands to spread the word about them and to stand out from the crowd in a positive way. Currently, over 1.6 million videos exist on YouTube devoted to unboxing experiences, with popular channels drawing around 2.4 billion views. It might be odd-sounding but this trend is not a niche, and is growing by 57% a year, according to Google.

As mentioned by Watkinson (2013) for a great customer experience nothing should be left to chance and when an order shows care for detail, it transmits to the customer that the business cares about them. It turns packaging in much more than just a mean of transportation, it becomes part of the luxury buying experience provided to the clients, in order to exceed their expectations.

2.2.2 Environmental Impact

The Internet has undeniably increased the mass production on a global scale. According to Sui and Rejeski (2002) the ease of pointing and clicking with no effort causes people to buy more. In terms of energy consumption, the just-in-time (JIT) delivery tends to create situations in which trucks are moving half empty. Furthermore, e-commerce also incentives faster transportation modes, which increases fuel consumption. The switch from transporting by trucks, instead of boat or rail, increases the energy expenditure by a factor of four to five. By airfreight the energy consumption is over seven times more. Clearly, a share of the increase in transport energy consumption can be attributed to the growth in e-commerce as it tends to encourage the consumer to choose more energy-consumptive alternatives, as faster deliveries.

As mentioned by Arienti (2019) these subjects of environment, sustainability and positive impact on communities are elements now taken into consideration when buying a product, and luxury goods are not an exception. In particular, younger generations and millennials are the most dedicated to sustainability and deeply care about a brand's ethical standards. Affluent millennial consumers want their luxury brands to provide a positive contribution with practical actions. They are willing to pay a premium price for those products that come from a conscious brand.

2.3 Methodology concepts

In order to frame the work that was being developed it was important to follow a systematic approach that structured each step taken. In this section two main methodologies will be presented: the first one - Design Thinking is more qualitative and is focused in idealizing solutions; and the second one - Continuous Improvement is more focused in quantitative analysis that help ground initiatives. Lastly, as one of the objectives of the project is to persuade partners to change behaviour, different influencing techniques are presented.

2.3.1 Design Thinking

In the early 70's, making cheaper products was a major objective of every company. According to Tschimmel (2012) when a product was designed with a lower cost price, chances were that it would dominate the market. A decade later, businesses are more focused on making their products better. However, it was just in the early 2000's, that the focus shifted to make good quality products, improve features, design, and usability. Nowadays, the focus of businesses is to develop products with people for people. As a consequence, real data started being used to develop solutions that users actually need and search for. Design thinking is a methodology used to develop new and different ideas. It can be defined as a human centered and collaborative approach to problem solving that is creative, iterative and practical. It is an essential ability to understand the user needs and to drive new initiatives to become successful. As it can be observed in Figure 2.3 this is a process composed by four steps (Stanford, 2015): Discover, Define, Develop and Deliver.

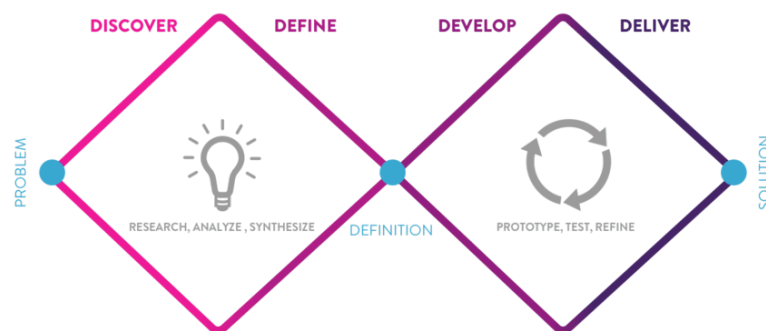


Figure 2.3: Design Thinking Process Steps; Source: Quintanilha (2017)

1. Discover

At the start of a Design Thinking Process, it is very important to understand what are the different difficulties that are being faced. Even though, most of the times, managers are aware of what the problem is (or at least its consequence), that does not mean that they are aware of the reasons why it is occurring and how to mitigate it. For this first step to be successfully accomplished it one should:

- **Observe:** View users and their behaviours in relevant contexts complemented by interviews. It is important to notice the disconnection that sometimes exists between what people say and what they actually do;
- **Engage:** In order to get a major receptivity, the engagement of all the affected parts is fundamental. Conversations should be scheduled to understand how people really feel about the topic. It is crucial to guarantee that the interviewee feels at ease to share their honest opinions.
- **Watch and Listen:** Ask users to show how they complete a task. Have them physically go through the different steps, while describing them and explaining the reasons why they are doing so. Observing the process in action can also highlight other perspectives and complaints that had not been mentioned before.

After listening to all the people affected by the project we have now a starting point of ideas that need further analysis. These will be the basis to develop the future solutions for the issues raised.

2. Define

The define stage of the design process is about bringing clarity and focus to the design scope. It is the moment when the design thinker has to define the challenge that wants to be defied, based on what was learned about the different users and their contexts. This stage is mostly about making sense of the widespread information that was gathered. The goal is to craft a meaningful and actionable problem statement. This should be a guiding statement that focuses on insights and needs, that emerged from a process of synthesizing information and discovering connections and patterns. Although it may seem counter intuitive to craft a more narrowly focused problem statement, it usually tends to yield both greater quantity and higher quality solutions when generating ideas.

3. Develop

Develop is the mode of the design process which is concentrated on idea generation. Mentally, it represents a process of “going wide” in terms of concepts and outcomes. It is defined by the transition from identifying concerns to creating solutions, it is the chance to combine the understanding about the problem scope and people with the ability to imagine and generate solution concepts. Particularly early in a design project, development is about pushing for the widest possible range of ideas that can be selected, not simply finding a single, best solution. The determination of the best solution will be discovered later through testing and feedback.

4. Deliver

In this last step of the methodology, an action plan is expected to be presented in order to reach the solution for the initial problem. It should include the requirements and different steps for each stage. The engagement of all of the people affected by the changes is important to avoid

resistance. Adequate training and communication is crucial to have a smooth transition and make people cooperate. The main stages for implementation are:

- **Phasing:** the different phases of implementation are defined, with a list of actions and requirements that each step obligates. Deadlines and deliverables should also be established in order to avoid confusion and keep track of the progress of the process.
- **Risk Management:** identify any final possible constraints and guarantee that the proposal is feasible to try to prevent possible obstacles;
- **Evaluating:** ensure that everything is going as planned, performance should be tracked and compared with what was previously defined. Measures must be delivered to visualize how well the project objectives are being achieved.

2.3.2 Continuous Improvement Techniques

Continuous improvement (CI) is a culture of sustained improvement that focuses on identifying opportunities to streamline and standardize work, while eliminating the waste and non-value adding activities of the company (Singh and Singh, 2015). This ideology, is based on the engagement of all the people in every area without making big capital investments. The main goal is to reduce costs, increase quality and service level, emphasizing the role of the main stakeholder: the Client (Bhuiyan and Baghel).

One of the highest priorities of every company is to achieve a competitive advantage that allows them to detach from the rest of competitors (Hines et al., 2004). Throughout the time, the CI approach has evolved from its manufacturing origins and is now able to also respond to services and technological companies (Ali Haddas et al., 2014). Sharp and McDermott (2002) believe that this evolution allowed companies to develop better operational and strategic objectives, aligned with effectiveness and efficiencies.

Nevertheless, CI does not guarantee success, according to Lodgaard et al. (2016), two out of three CI initiatives fail to meet the desired results. Different causes may result in failure such as: misleading tools usage or organizational and managerial barriers. To secure that CI responds to the enterprise needs and expectations, it is mandatory to support the initiatives with the adequate training and motorization, as well as, a good adjustment to the organization's culture. Below, a short explanation of the different tools that were used during this project will follow.

1. Swim Lane Diagram

A very important aspect in the performance of an organization is the design of the current processes, meaning that, the structure and configuration in which they are arranged can change dramatically their effectiveness (Bersin et al., 2017). An effective process is the starting point to achieve a better operational performance, improve quality, speed and flexibility, and decrease costs. Slack et al. concluded that process design acts as a management tool that helps describing the AS-IS state of the process by providing an holistic approach of the operational context.

According to Chase and Jacobs (2006), the swim lanes are a graphic representation of the workflow in a logic sequence, that represent the several activities and how they interact with each other. Additionally, it brings visibility to possible improvements such as: removing duplicate activities and contributing to identify inefficient activities that should be outsourced. Swim lanes are one of the most used process mapping tools due to its easily understandable representation and ease of use Aguilar-Savén (2004).

2. Ishikawa Diagram

The Ishikawa Diagram, also known as "Cause-effect diagram", is a particularly effective method of helping to search for the root causes of a certain problem. It has become extensively used in improvement programs because it provides a structured way to deliver brainstorming sessions. Traditionally, the causes are already pre-established, however, any categorization that is more adequate for the particular problem is accepted, as far as it covers all relevant possible causes (Slack et al.). Figure 2.4 illustrates such a diagram.

This methodology can be complemented with the Why-Why Analysis, which consists in a method of asking several "whys" for a problem to occur. Once the reasons have been identified, each one of them is taken in turns and asked again "why" they occurred and so on. By introducing this extra step to each cause, it is possible to identify the real root sources of the problem and facilitates the development of counter-measures that will prevent it from recurring (Knop and Mielczarek, 2018).

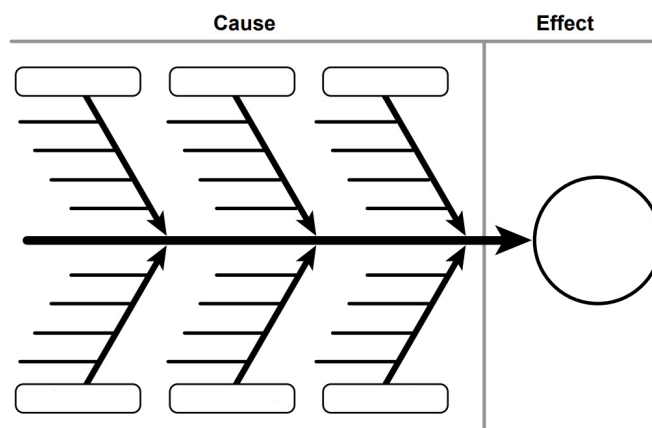


Figure 2.4: Ishikawa Diagram Model

3. Control Charts

Control Charts are used to check and monitor the quality of a process over time. They are composed by a central line for the average and an upper and lower bounds, that are used as control limits. The spacing between the two limits is defined by historical data and the variation that exists in it. Typically, control charts are used to: a) control ongoing processes to help identifying in which moment the problems occurred; b) predict the expected outcomes from a process; c)

determine if the process is statistically "in control" or if it needs fundamental changes; d) analyze patterns of the process variation for special and common causes (Tague and Siebels, 2005).

According to Koutras et al. (2007), a process can be considered out-of-control, in case at least one of following situations occur:

- At least one point outside the 3-sigma line;
- 8 consecutive points fall on the same side of the centerline;
- 4 of 5 consecutive points fall between the 2 or 3-sigma line;
- 14 points in a row alternate up and down;
- 8 consecutive points are not in the green zone of the graph;
- An unusual or non random pattern is found in the data.

4. Pareto Chart

The Pareto analysis is based on the phenomenon that relatively few causes can explain the majority of the effects. The underlying rule behind the Pareto principle developed by Vilfredo Pareto, is that in almost every case, 80% of the total issues incurred are caused by 20% of the reasons. Therefore, by concentrating on the bigger problems first, the majority of the occurrences will be eliminated (Leavengood and Reeb, 2002).

The purpose of the Pareto diagram is to sort the information about the frequency of the different types of problems or causes. It is also used to highlight critical areas where investigation should be developed (Slack et al.).

2.3.3 ROC Curve

The ROC curve technique has been designed to attain two objectives: first, it can be used to calibrate a test by performing an evaluation about how well the test is able to discriminate an activity; second, it can be used to choose the best test among many. According to Fawcett (2006), given a classifier and an instance, there are 4 possible outcomes from the statistical testing: true positives (actual positives), true negatives (actual negatives), false positives (negatives that were considered positive) and false negatives (positives that were considered negatives). With this set of instances, it is already possible to represent a confusion matrix, as represented in Figure 2.5. As mentioned by Ping Shung (2018), from this matrix it is possible to calculate many common performance metrics such as: the true positive rate (also called "hit rate" - TPR); the false positive rate (also called the "false alarm rate"); the precision (which calculates the quality of the positive prediction); the recall (which measures sensitivity of the model to detect positives); and the accuracy of the test (which is the percentage of items correctly classified). Every expression for each metric is given on the right side of Figure 2.5.

		True class			
		p	n		
Hypothesized class	Y	True Positives (TP)	False Positives (FP)	$FPR = \frac{FP}{N}$ (a)	$TPR = \frac{TP}{P}$ (b)
	N	False Negatives (FN)	True Negatives (TN)	precision = $\frac{TP}{TP+FP}$ (c)	recall = $\frac{TP}{P}$ (d)
Column totals:		P	N	accuracy = $\frac{TP+TN}{P+N}$ (e)	

Figure 2.5: Confusion Matrix and Common Performance Metrics, Source: Fawcett (2006)

With the previous metrics, we obtain a discrete classifier of the model in that specific output. Meanwhile, with a ROC curve it is possible to measure the trade-offs between benefits (true positives) and costs (false positives) for different levels of accuracy (Fawcett, 2006). Figure 2.6 illustrates an example. To interpret a ROC curve, we should take into account where the higher left point (referred as classifier) is located (point "a" in Figure 2.6): if it is placed with a TPR of 100% and a FPR of 0% it means that the model is a perfect representation of reality (point "b"); classifiers appearing on the left-hand side of a ROC graph are considered more "conservative" since they only make positive classifications with strong evidence. Classifiers on the upper right-hand side of the ROC curve are thought as "liberals" because they consider positives with weak evidence. The AOC curve represented in Figure 2.6 illustrates a random performance of the model. Thus, classifiers below that curve should be ignored (Flach and Wu, 2005).

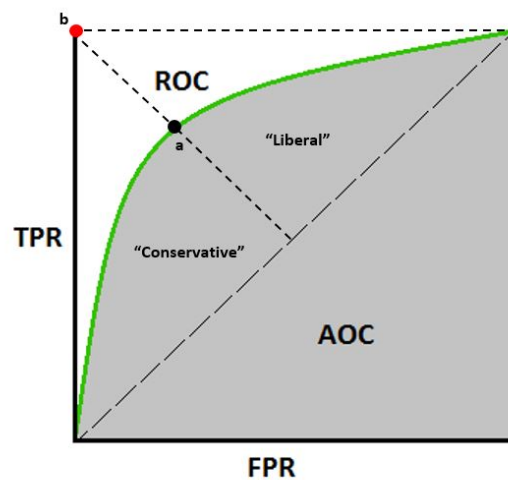


Figure 2.6: ROC curve example; Source: Narkhede (2018)

2.3.4 Influencing Techniques

According to Nazar (2013) when someone is trying to influence others to change their behaviour, it is important to create a clear difference from manipulation and actually try to show how this change can work in their own best interest. Be persistent and communicate clearly, set the right expectations (overly demanding will only cause frustration) and instill a sense of seriousness and trust to the people you want to influence: excessive control makes people lose the feel of ownership that is fundamental to create engagement.

Influencing Strategy dependent in Channel Structure

When trying to determine which influencing technique is more beneficial for the business it is essential to understand which communication structure exists between the involved parts, according to Boyle et al. (2015). Mohr and Nevin (2006) elaborated that, a communication channel depends on three critical planes:

- Climate, the extent to which channel members feel trust and support;
- Power, the extent to which dependence is balanced between parts involved;
- Structure, rather the interaction and trading is continuous or discrete .

If the relation is defined as more collaborative, the best influencing techniques are recommendations, transparency and quality of communication. If, on the other hand, it is established as a market channel system, the best persuasion techniques are promises, pleas and requests.

2.4 Final Considerations

Throughout this project there are several dimensions that need to be taken into consideration simultaneously. Naturally, the business environment conditions every decision. For instance, to maintain the luxury appeal and exclusiveness perception, Farfetch needs to pay attention to the products it sells and the promotions it launches in order not to damage its image. The quality level of the service needs to be very high and rigorous to reach customers expectations. Meanwhile, all these requirements need to be accomplished through a marketplace model, where very little control exists concerning what partners do and what they sell.

In another perspective, these new market trends are also important to be incorporated in the scope of the problem, such as the unboxing experience and the environmental concerns. Considering that Millennials and Gen Z are particularly sensitive to these issues, incorporating these topics will bring more depth and meaningfulness to the work developed.

Lastly, both the Double Diamond and the CI tools methodologies seem accurate to explore the problem in question. As they complement each other, this dissertation will have an overall analysis from both a qualitative and a quantitative point-of-view respectively.

Chapter 3

Problem Description

The context of this project has two peculiarities: first, the company does not have the products during the order processing and second, the luxury market operates with very demanding customers, that have strict requirements. During the entire process, Farfetch has only access to the items when a sample is sent to the Production Centers, in the beginning of the season. The creation process to put the product online will be further explained in Section 3.2.3, where for the first time the packaging information will be added.

In this section, the key processes of the organization will be described and divided in 3 different categories. The first is the order processing process (3.1) with a description of the several stages every order goes through. The second will be related to all the processes involved with the packaging project, such as the cardboard packaging supply chain (3.2.1), the packaging recommendation (3.2.3) and the packaging control system (3.2.4). Additionally, Farfetch boxes sizes and the different components and attributes will also be presented. Finally, the problem faced will be described together with a critical analysis about it (3.3). Hereafter, Farfetch will be mentioned by the abbreviation FF.

3.1 Order Processing

In order to understand how every order is placed and where problems might arise, there are a few concepts that are essential to master about how partners handle orders and each step they go through, before their box is dispatched.

Every time a customer adds items to its basket, it is possible that they come from different origins which creates 3 different concepts: Portal Order (PO), which consists in the total amount of products that the client placed, regardless of the place where it is being stored; Boutique Orders (BO), which consists in the different products that necessarily come from the same boutique to the same single customer; and finally the Product Order, which is composed by each one of the items individually. This granularity of orders is important as highlighted in the following example. If a boutique with two items in a BO happens to have a No Stock in one of them, it is possible for

FF to look after another boutique that has the product and place it to satisfy the client as much as possible.

After an order has been placed the store needs to go through six different steps represented in Figure 3.1. All of them unfold in Farfetch's operations internal app called STORM ¹:



Figure 3.1: High-level order processing

1. Check Stock The boutique needs to confirm that they have the stock required and that they are able to process it. If they do not have the item and declare "No Stock" they will be penalized in the Incentive Plan that will be explored later in Section 3.2.5. After an attempt to replace the product required, FF contacts the customer and suggests a similar product or performs a refund.

2. Approve Payment

Simultaneously, with the boutique checking its stock the approved payment step begins. According to its customers profile, they can be classified in three different lists: Black-List, White-List and No-List. For No-List clients, that do not have a profile yet, FF works with an external third-party that is specialized to detect credit card fraud or suspicious behaviour. For some specific cases of doubt, the order can be placed on "Under Investigation" status and verified manually by an internal team.

3. Decide Packaging

This is a simple step, but it is very important for this project since it is the first time that the partners have access to FF packaging suggestion. Here they can accept the suggestion or change it to the box that they feel is more adequate for the product. Additionally, if they do not want to be penalized for using a bigger box, they can also create an exception saying the reason why they are choosing it and, if accepted, this particular order will not be taken into consideration in their Packaging Accuracy metric, which will be further explained in Section 3.2.4.

4. Create Shipping Label

This is the printing step, when the boutique issues the paperwork that is needed for the carriers and the client. It includes the air waybill, that needs to be casted outside the box, the receipts and

¹ back-office product that allows all the partners to manage their own orders, stocks of products online, etc

the returning instructions and labels. All the different inside components are putted together inside a document wallet, including country and FF stickers.

5. Send Parcel

Now the parcel is ready to be picked up by a carrier, FF informs the selected carrier they can already proceed with the pick up.

6. In Transit

The sixth and last step is when the order is already outside the store and on its way to the customer. The end of this process is determined by the arrival to the client. It is expected that the box arrives without any signs of damage and that all the components are well disposed in order to maintain the luxury unboxing experience that should amaze our customers.

3.2 Packaging Related Processes

3.2.1 Cardboard Packaging Supply Chain

The packaging supply chain is composed by four different steps in which, Farfetch is mainly responsible to transmit, allocate and place the orders received from the boutiques. As it can be seen in the Figure 3.2 the process starts with the different boxes being produced from 5 different suppliers. Afterwards, the different components (cardboard boxes, wrapping paper to protect the items, invoice holders, security and card tags to secure that the pieces are not used and later returned, and the country and Farfetch stickers) presented in Figure 3.3 are gathered in a 3PL that is responsible to deliver the ordered amounts of each component to the partners, following FF orders. The last steps of the chain happen when a new order from the final client is placed and needs to be packed and shipped to its final destination.



Figure 3.2: High Level Cardboard Packaging Supply Chain

The boutiques are totally responsible to make the forecast of materials that will be needed during the next orders, both in terms of box sizes, volume and frequency of orders. The 3PL commits with a 2 days service level agreement (SLA) to make the delivery. Boutiques are obliged to use FF boxes in all the orders, as agreed in the contract with them. The company is very strict with that rule, to try to create a consistent image, while maintaining a strong branding.

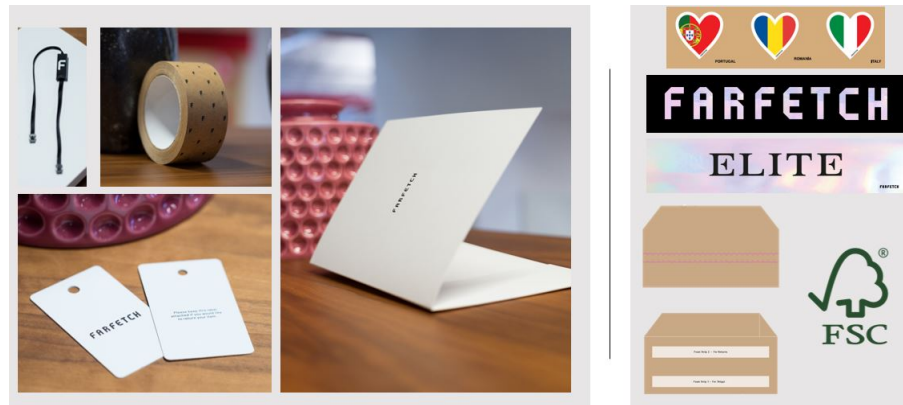


Figure 3.3: Packaging Components

3.2.2 Farfetch Packaging

As a consequence of the very diversified assortment of items that Farfetch sells in its website (from earrings to high-heal boots), packages need to be versatile enough to accommodate all the different products. Besides the packaging sizes, another concern is the design, on one hand, most of FF products are very expensive and the box must not be recognizable to avoid being stolen, on the other hand, clients are expecting a luxury unboxing experience beyond the simple cardboard box. This is the main reason why FF added the personalised stickers, personal note and the easy-to-open box, characteristics that distinguish the company from other e-commerce platforms.

The last requirement is more functional, since FF wants its partners to achieve excellent operational performance, and therefore develop boxes that are easy to fold and pack.

FF currently has three different box sets: one set that is only delivered in Brazil, another one in the US and the third in the Rest of the world (RoW). For RoW, the current set resulted in 9 different sizes, presented in Figure 3.4, with the size characteristics detailed in Appendix A. The RoW box set will be the main focus of this project since 88% of FF orders are dispatched in it.

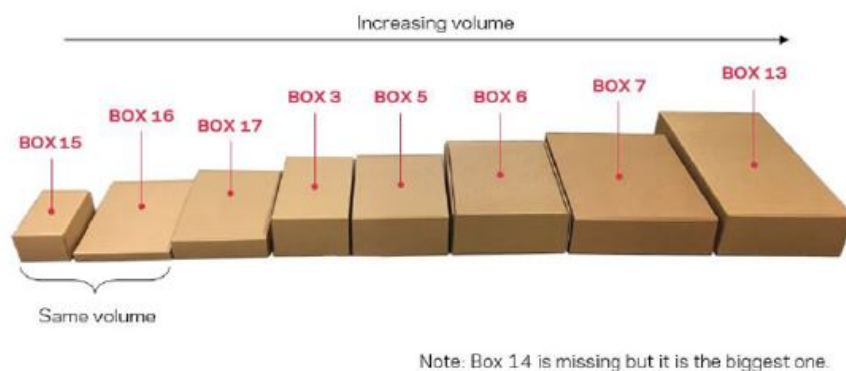


Figure 3.4: Representation of RoW boxes

3.2.3 Packaging Recommendation Process

Every item in the FF website needs to be created on the website and photographed, in order to be able to go online. With the aim to have a consistent brand image in the platform, all of the products go to one of FF's production centers (Hong Kong, São Paulo, New York or Guimarães) where they are shot and its main information is saved. That step is called Scan-Out and it is the moment when a worker inserts all of the information containing materials, colors, sizes, washing instructions, among others. One of the fields is the packaging considered most adequate for that product. This is the first recommendation that is given, which can be consulted both in Step 3 of STORM or in the order details sheet ². The production recommendation remains for the first five evaluated orders of the same designer ID ³.

After that, there is an algorithm that evaluates the orders of each particular designer and verifies whether the suggestion currently given is the most adequate. To do that the algorithm compares FF suggestion with the box sizes that were charged according to the threshold prices that were previously agreed with the carriers (these intervals can be seen in the Appendix B). This recommendation changing process will from now on be mentioned by overwrite, it is runned manually every second week and follows the subsequent rules:

- For a total number of orders between 5 to 9, the algorithm only changes the box recommendation in case at least 2 of the orders were dispatched in a smaller box than the one recommended;
- From 10 orders onwards the algorithm alters to the smaller possible box which was assigned for at least 20% of the orders dispatched;

In Figure 3.5 it is possible to observe a graphical representation of the previous process described.

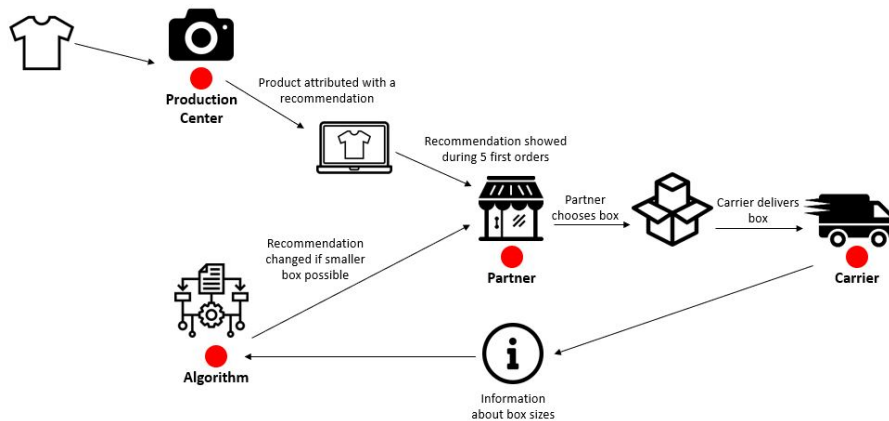


Figure 3.5: Recommendation Process

Given that it is possible to know accurately which box was used by the partners, an algorithm was developed in 2018 to try to predict what is the best box for each product. It consists

²Printed summary of the order with the different details of the products

³Nomenclature used for items of the same model but that can have different colour schemes and sizes

in an algorithm based on machine learning models which tried to independently find patterns between its characteristics and generalise the ideal box based on them. With this predictive model, photographic production could be dismissed from the recommendation task, changing the current process flow. However, since results were not satisfactory enough, this model ended up by never being implemented.

3.2.4 Packaging Accuracy

Last year, when the packaging concern was raised for the first time a new control system was settled. In order to know which boxes were being shipped by the partners, the link between what was being sent according to the invoices that were charged and the adequate box had to be made (using again the thresholds Appendix B). To evaluate the performance of the partners a new metric was created: "Packaging Accuracy"; that measures the percentage of orders that used the recommended box or a smaller one in the moment that the order was placed. The Packaging Accuracy can be calculated by the following Formula (3.1):

$$\text{Packaging Accuracy} = \frac{\text{Number of orders shipped with the recommendation size or smaller}}{\text{Total Number of Orders}} \quad (3.1)$$

Farfetch's current target for the packaging accuracy is 85%. However, over 2018 it has never exceeded 76% and achieved an average of 74.4%, as it can be seen in Figure 3.6. Note that all the orders that had an accepted exception regarding the box sizes are not taken in consideration in the calculation.

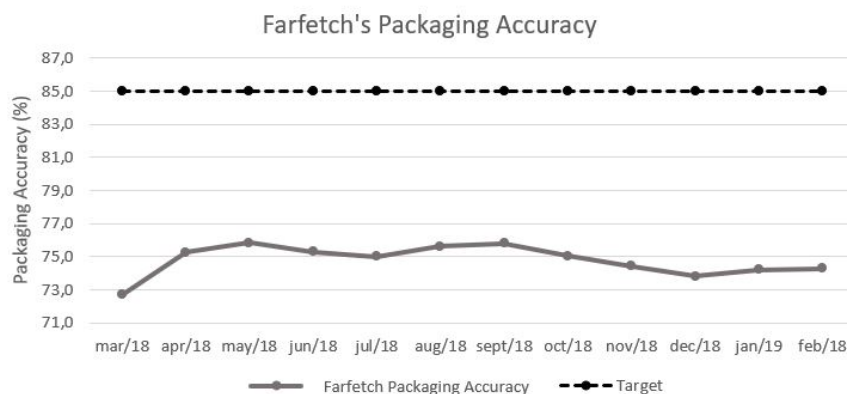


Figure 3.6: Gap between current Packaging Accuracy and 85% Target

3.2.5 Packaging Incentive

To encourage partners to foster a better operational performance and to increase customer experience, Farfetch benefits or penalizes them according to different metrics results. The last

version of this compensation plan (Service 4.0) was launched in 2018 and is composed by the following metrics: % of no stock, which happens when the store does not have the item to fulfill the order; speed of sending which is the time the partner takes to have the order ready to dispatch; % of wrong item sent to the customer; and the packaging accuracy incentive. Currently, the first two metrics are the ones that have the biggest impact on the total amount of the incentives provided.

The newest incentive added was the packaging accuracy (PA) incentive, with the aim to incentivize our partners to help reducing shipping costs, increase customer experience and reduce Farfetch's environmental impact. Here, partners are only subsidized if they have a monthly average of at least 85% of PA. The value that the partner receives is calculated with the Formula (3.2), where GTV Delivered stands for the sales value of all the orders that were delivered to customers.

$$\text{Packaging Incentive} = 0.04\% * \text{Monthly GTV Delivered} \quad (3.2)$$

3.3 AS-IS Critical Analysis

This new tracking model, the insertion of the KPI in the business dashboards and the monetary incentive given to the partners was just implemented, as mentioned before, in March 2018. Since this is still a newer process, there are many opportunities to improve it, besides only encouraging partners to change their behaviour and follow the recommendation. After understanding how the "business as usual" is flowing, the next steps are to analyse the different constraints that are being faced.

3.3.1 Algorithm Limitations

The algorithm already mentioned in Section 3.2.3, responsible to change the recommendation provided in STORM, has a few constraints:

- It only acts after 5 orders of the same *DesignerID*;
- It only evaluates one of FF carriers information;
- Only orders that are charged by volume are able to be linked to the box size;
- Invoice number is correctly associated with the order;
- Boutique orders can only be composed by a single item;
- Items need to have a recommendation associated at the moment of the sale;

All of these conditions impact the performance and quality of the process. Since only 25% of the items sold at FF reach five orders this means that the majority of the products rely on the

suggestion filled by hand in the production center. Additionally, as can be seen in Figure 3.7, due to the rest of the constraints previously mentioned, only 63% of the boutique orders delivered last year were able to be evaluated. As a consequence, the PA metric loses accuracy due to the small sample used to calculate it, which results in a loss of credibility and lack of understanding by the boutiques about how it is calculated. A higher coverage is important to motivate and influence the stores to achieve significant improvements, as well as, to have a more realistic view of what is being sent.

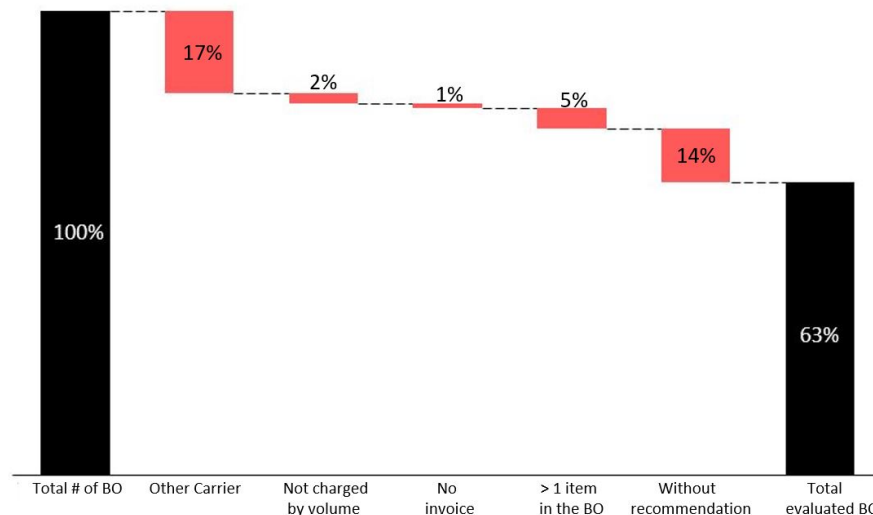


Figure 3.7: Packaging Incentive Scope

3.3.2 Recommendation Process Limitations

In terms of the recommendation process there are also some limitations. The most impactful is the fact that the box selection is completely open to manual input. Considering that production has very strict targets for the time spent scanning each item, having all of the box sizes available for every product only complicates the choice and allows errors to occur very easily. Boxes that could never be used for a specific category of an item are presented, which results on the worker having option paralysis.

3.3.3 Machine Learning Algorithm

The algorithm mentioned in Section 3.2.3 takes into consideration the following variables: Category, Gender, Season and Brand. Even though, the results of that algorithm were not satisfactory enough to substitute production, its usage should not be discarded. For some specific cases and limitations, such as products without a recommendation, this tool can convert in a very useful and time saving mechanism. In Appendix C it is possible to see the prediction accuracy of the algorithm according to the different variables that are being taken in consideration.

3.3.4 Overwrite Limitations

Another existing limitation of the percentage of sales that the algorithm is able to evaluate. As an example, in Figure 3.8 we can observe the amount of orders that products produced in April 2018 had, counting the days since they have been online (black line). It is notorious that the higher peak of sales occurs around 50 days after the product has been online. The other curve in the graph represents the percentage of sales, from the same products, where the recommendation given was secured by the algorithm. Here, we can detect that the sales coverage by the algorithm is only significant very late in the season. When the products are selling the most the recommendation provided is the one given by the photographic production (the algorithm covers only around 20%). This can be explained by the time that exists between the order being shipped and the receipt from the carrier to arrive. Additionally, the bi-weekly manual overwrite also delays the process (and if other problems emerge this overwrite will be postponed), making the high coverage of sales desired to be only reached 5 months after the product being created. This is particularly aggravated in production months before sales (like April) where products are most sold right after being online. Another factor that impacts the late response is caused by only evaluating 63% of the orders. These results in the algorithm only taking action after 8 real orders in average where dispatched of the same *DesignerID* instead of the 5 required.

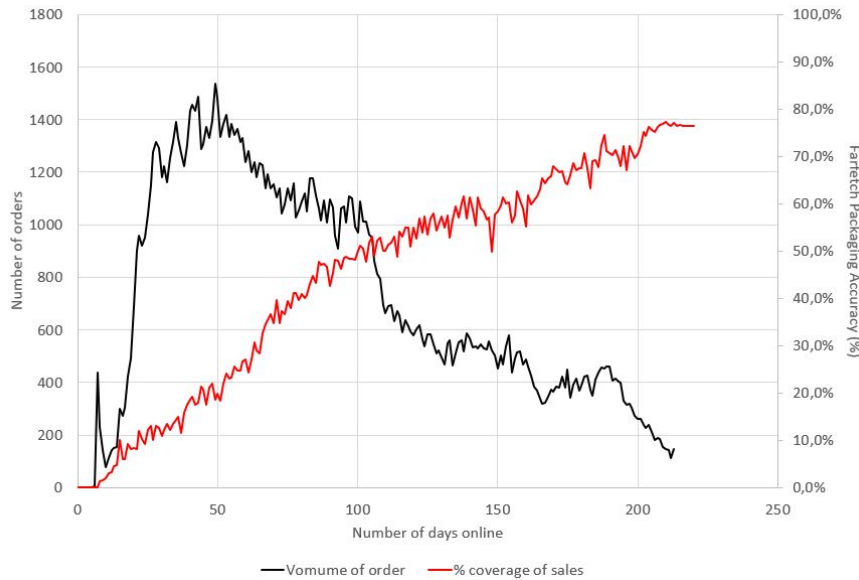


Figure 3.8: Algorithm sales coverage vs items sales volume

3.3.5 Packaging Accuracy Incentive Limitations

Figure 3.9 shows the partners (in %) that are eligible for the Packaging Accuracy Incentive, which is around 35 %. Additionally, the average incentive presented per month is around 30 USD, with a range between 0.20 USD and 450 USD. When compared with the values of the main incentives, described in Section 3.2.5, this one has no relevance, because the other metrics' incentives

can reach 50 000 USD. Clearly, partners do not feel motivated by this incentive and, therefore they do not make efforts to achieve the target. This corroborates the fact that the communication emphasis with the partners should be about sustainability and customer experience, instead of monetary value. Lastly, it also important to mention that none of the Top 20 selling boutiques were ever eligible to receive this incentive.

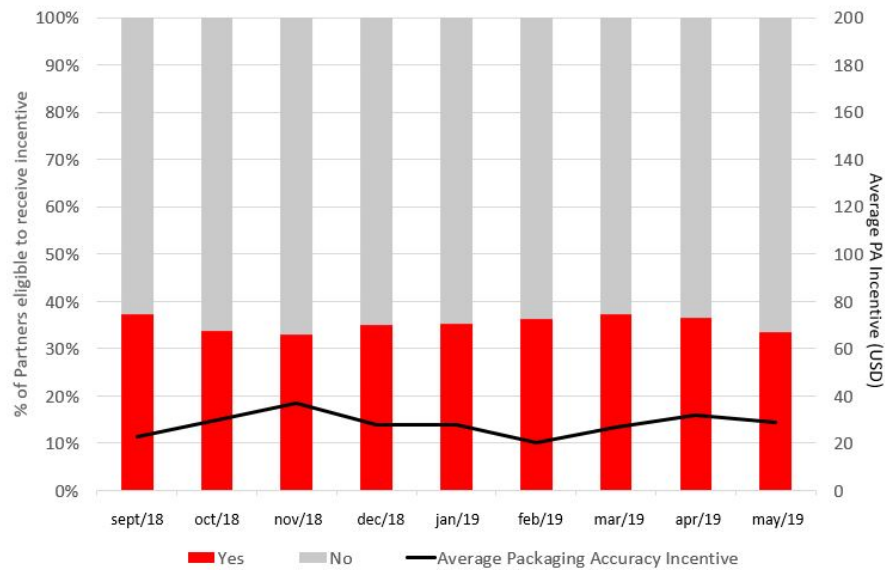


Figure 3.9: Partners eligible for PA Incentive and average incentive value

Chapter 4

Methodology

This chapter presents a conceptual framework to evaluate the current process, together with the main opportunities found. Each one of them is accompanied with the correspondent impacts and advantages to help solving the current problem of having an overall low Packaging Accuracy that is very far from the pretended target. The methodology followed is the same as the one presented in Chapter 2 which now will be developed step-by-step with the "Double Diamond" approach used in the Design Thinking Process. Thus, it will be possible to ground the different decisions that were undertaken during the project, as well as future-steps. Complementary to this technique other tools of continuous improvement will be added during the different stages to enrich the overall analysis.

4.1 Discover

In Chapter 3, the current AS-IS process was described, as well as, the Packaging Accuracy current issues, but we need to understand what are all of the causes for those problems to start drawing a path to achieve a solution. As mentioned before in Section 2.3.1 in this exploratory phase it is fundamental to understand what is actually happening with the different entities involved in the process. We held meetings with the all the Production Centers (PCs) and additionally some visits to Guimarães's PC occurred. During this period, we had the chance to observe and discuss with the people that perform the scan-out task on a daily basis and mentioned what were the main pain points. On the partners side, 25 boutiques were approached as well as their "Partner Success" responsables¹ to hear about their complaints about the algorithm behaviour, their thoughts about the packaging itself and reasons why they were not following the suggestion. Finally, we contacted the algorithm creators and the new process implementors that could also provide insights on why the recommendation is not totally reliable, as well as provide context about the different initiatives that were already accomplished within the Packaging theme.

¹Farfetch workers that are responsible to monitor the boutiques' performance. They are in charge of solving problems and reporting issues

4.1.1 Process Mapping

In order to understand and visualize what we were observing and discussing during the different interviews it was necessary to draw flowcharts of the different processes in order to identify possible issues and efficiency gains. By modeling the different steps and people in charge of them, we were able to illustrate the dependencies and impacts that changes may bring and who will be affected by them. Lastly, another objective was to standardize the process of the different stores, depending on their order volume and if they perform their operation in a store or in a warehouse.

For the packing station, the different steps that we could identify are represented in Figure 4.1 which contains the sequence of actions from the order being gathered until it is ready to dispatch to the final customer.



Figure 4.1: Packing Station Steps

The processes that are drawn in Appendix D are: Packaging Supply Chain (Figure D.1); Recommendation Process (Figure D.2) and the Order Processing Process of a warehouse (Figure D.3) and a store (Figure D.4). Framed on the scope of this first design thinking step it was now necessary to make a deep-dive in the root causes for the different reasons and sources of error for a wrong package to be sent. The next steps will be to understand what are the different explanations for an error to occur and how the different partners order processing proceeds.

4.1.2 Control Charts

After analyzing both the flow of the different processes that involve packaging it was necessary to understand if the packaging process of different stores was under control or not. As an example, in Figure 4.2 one can see the X-bar control chart from the largest partner in FF website (responsible for almost 10% of annual sales). We can observe that since February 2019 the process has been out of control, not only because it is in the red zone but also because the series is entirely on the same side below the average. Additionally, even before February the process was not in control, as there are more than 8 consecutive points on one side which indicates a tendency in the accuracy data (in this case a constant decreasing one). Other examples can be observed in Appendix D: Figure D.5 is the general Farfetch graph where it is possible to identify seasonality in the value of the PA, and directly linked it to the high level of sales that occurred between November and March (Black Friday, Christmas and AW Sales), harming the PA. This indicates that the process needs to be improved because it is not under control. Even in Figure D.6, which represents one of the top performer partners, we can examine that the exact same tendency applies: when sales increase

packaging accuracy decreases (note that even in the worst months this store is above FF target, which is 85%, unlike the larger store that never even reached an accuracy above 80%).

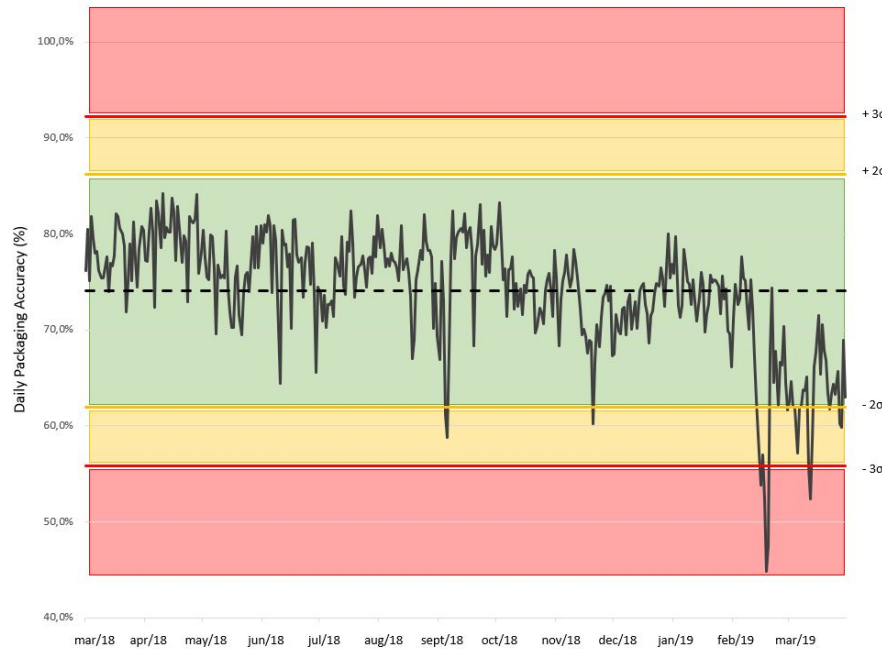


Figure 4.2: Packaging Accuracy Control Chart for the Biggest Farfetch Partner

4.1.3 Ishikawa Diagram

With all the input gathered in the different interviews and observations, the next step was to draw a Ishikawa Diagram with the purpose of identifying which errors occurred more often. In Figure 4.3 it is possible to observe the high-level categories of causes that happen during the partner's order processing and the recommendation process. In Figure D.7 we can observe in detail the different reasons for error in each category. This process is not a typical industrial case so the usual categorization is not used. Instead, issues were clustered together by the common entity that provokes them, namely People, Process, Stock, Photographic Production, Product and Recommendation Process. For some of the causes mentioned an additional "Why-Why" is necessary since more insight is needed in order to understand how they can be overcome.

People: when addressing problems such as: lack of training, lack of engagement or no clear communication; the main reasons identified were: that managers do not give enough importance to this matter, do not transmit clear guidelines and do not encourage workers to pay attention to the recommendation. Cascading the information all the way down from the manager to the packing worker can be complex and is aggravated by the high turnover of staff that exist in such jobs. Another reason "why" is the lack of educational materials and performance indicators provided by FF that clarifies how stores are performing and how they should behave. For the excessive

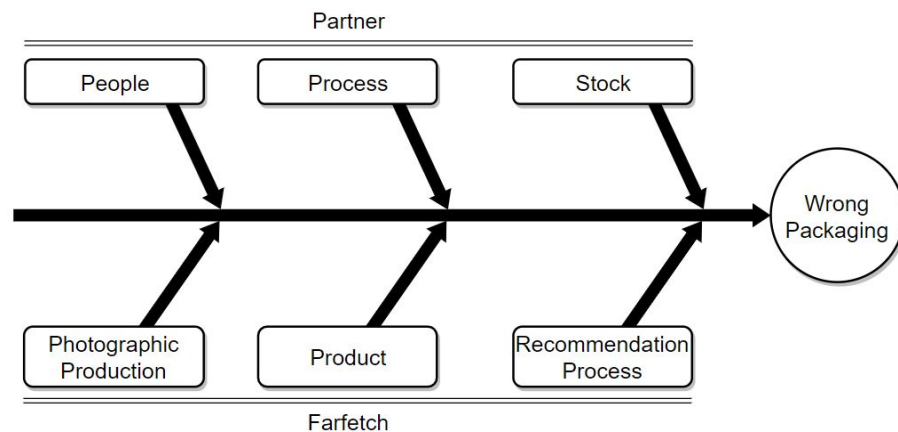


Figure 4.3: High-Level Ishikawa Diagram

workload the main "why" is due to the lack of ability from the partners to deal with the high seasonality of the apparel sector, which makes managers shift focus on other more important KPIs like Speed of Sending mentioned in Section 3.2.5.

Process: when approaching the process issues there are two main reasons for errors to happen:

- **Partners cannot have access to the recommendation:** For partners that, instead of using STORM, are fully integrated with their own specific systems no efforts were made to allow our packaging recommendation to be visible in their own interfaces. Additionally, Farfetch's API is not able to send this information yet, so even if the partners were willing to make the developments needed in their integration it would not make any difference. This scenario occurs when partners do outsourcing in an already established warehouse that obliges them to make a full integration of all the different order processing steps or because they have a more automated warehouse where STORM does not support all the requirements that are obliged;
- **Packaging recommendation cannot be seen:** The process established in big partners has a processing line composed by different employees in separate stations. There is usually no computer access in the packaging table, which means that even though the person that prints out the shipping documents afterwards has access to the information, the order has already been packed and is ready to dispatch, it is too late in the process to make any changes. Besides, when the packing worker is making the choice of the box, in case it is necessary a bigger one than the recommended, they are not aware of it so no exception will be created;
- **Boxes are not labeled:** Even when the recommendation is visible, sometimes the workers pick the wrong box because they were not labeled and the worker was not able to distinguish the appropriate size. This occurs more often in stores that have a lot of temporary workers during peak season.

Stock: partners sometimes do not use the recommended box rather because they have a poor box inventory control, which results in some sizes suffering stock out or because they believe they do not need to order all the box sizes that exist which results in bigger boxes than needed being used.

Photographic Production: The reasons why production provides the wrong packaging information are: 1) boutiques only send the products that are going to be shooted, which in the case of shoes is only the right foot. Since items are sent in bulk ², the product boxes are also never sent to the photographic production centers to reduce shipping costs. As a consequence it is harder to predict which one is the right box, because the item will be sent inside the original box for the final client. 2) the product is only folded after the scan-out stage which means that the person that makes the choice of the box didn't saw the final volume that it occupies. 3) there is lack of training and visibility of performance to the scan out team, the main reason is that: this is a recent project and the adequate dashboard and control procedures have not been established yet. Workers in the scan-out station are not aware of how well they are performing and which mistakes they are making repeatedly. 4) the box field is not mandatory to fill and the reason "why" is because some articles do not fit in our boxes, such as furniture or umbrellas which means that in some specific cases none of the boxes are appropriate. This results in items living digital production without any recommendation to be showed to partners in the first orders. Lastly, in Figure D.8 we can observe the large list of boxes the employee can choose from for every item which complicates the decision making process and allows wrong boxes to be selected not purposely.

Product: the sizes of the same product packed can be different, due to different folding techniques used by some boutiques that send the items with hangers or dust-bags. Alternatively, shoes have a big amplitude of sizes and consequently different brand boxes which can result in the same product not being able to be sent always in the same FF box.

Recommendation Process: the wrong box is shown because: production selected the wrong box for that item or because the product is registered with a box from another box system and no conversion is made. For example, a product that was produced in the US and was associated with an US box, since each product can only have one single recommendation associated, in an European store that uses the RoW box sizes and sells this same product, the recommended box that will appear to the partner will be wrong. For the non-existing box recommendation the main "whys" are not applicable box, no filling in production or a partner created an already existing product with the same ID and did not fill the box field and makes the production recommendation disappear. When the algorithm performs a wrong recommendation change is because a partner with high volume is permanently sending the item in the wrong box creating biased results. To finish the causes for wrong recommendations, it was also identified that as the RoW system is the

²Cargo that is transported unpackaged in large quantities

most used there is no correction made for the remaining sets which implies that the production recommendation will never be changed.

4.2 Define

Now that we have determined the different issues and causes within the scope of this project, we need to explore the impact that each error brings to the process, in order to later decide which opportunities should be prioritized. As mentioned in Section 2.3.1 at the end of this stage we should be able to have a meaningful and actionable problem statement that describes what is meant to be solved. It was after this definition phase that the main goals presented in Section 1.3 were established, aiming to achieve the target of 85% PA (considered a reasonable level of accuracy) . To start this stage we had to assess if the way we were evaluating the boxes used by the store was fair and to understand if the invoices of the main carrier are a trustworthy source of information.

4.2.1 Algorithm Evaluation Quality Control

The main information that our algorithm uses to generate historical data about the different orders' boxes is the threshold charged by the carrier to FF. Since this is information coming from an external source, Farfetch was concerned about the accuracy of that information. To evaluate the performance, a quality control of their receipts was made in a 2 week test. During that period, the measures taken by the cubiscan ³ was matched with what we were charged. The results from that test can be seen in the Table 4.1. This specific carrier has an accuracy of 98.89% and a precision of 99.06%, calculated according to the expressions of Figure 2.5. The true positive rate is 99.44% and false negative rate is 0.27% which indicates that the measuring process has a good balance between having strong evidence but not being too much "conservative".

Table 4.1: Confusion Matrix from Carrier Results

		Reality	
		Positive	Negative
Hypothesis	Yes	105,650	1,007
	No	589	36,753

Afterwards, the robustness of the measures was assessed by changing the upper and the lower bounds of thresholds in Appendix B. They were changed one at the time starting from a measure closer to the real box measurements and increased with an interval of 0.1 cm^3 until the value of the next volumetric box size. In Appendix A, we can find the exact volumetric weight of each box size to help understand the thresholds variance that was considered during this test. For example, for box 15 and 16 the top threshold could vary between [0.7;1.4]. Figure 4.4 presents the ROC

³Machine used to scan and measure the different dimensions of each box

curves that were drawn out of these experiment for box sizes 15 and 16. With these values, we can observe that when the interval is tighter than the current threshold used, the true positive rate loses accuracy (however never below the 65% of accuracy) and as far as we increase the accepted range, the TPR also increases together with the FPR. After making this analysis we can observe that the information of the carriers measurements represents a trust-worthy source of knowledge to control what the boutiques are actually sending.

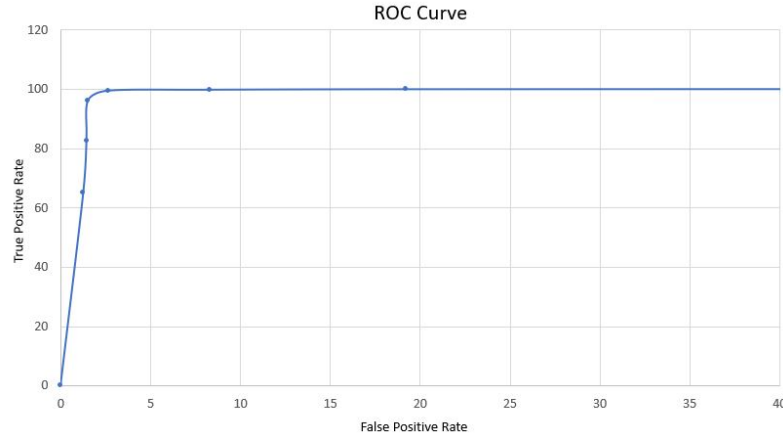


Figure 4.4: ROC Curve of the carrier for Box 15 and 16

The other boxes sizes yield similar curve values which indicates that the cubiscan machine that takes the measurement has constant variability independently of the box that is being measured.

4.2.2 Errors occurrences analysis

After understanding the different causes of each error and the reason why they occur in Section 4.1.3, it was important to verify which errors occurred with the most frequency in order to start defining which "pain points" should be addressed first.

To define the proportion that was going to be attributed to each one of the causes, different approaches were undertaken. The first split level was precisely between these two main causes: Partner or FF (which includes both Production and Algorithm mistakes). For the partners' reasons, 25 boutiques were chosen (15 of them as "Biggest Offenders" ⁴), interviewed and according to their answers it was possible to calculate the frequency for each Process and People mistake proportionally.

This technique was applied for the drivers where Farfetch did not have any visibility or data upon. For the following categories: "Integrated partners"; "Don't order all needed boxes" and "No stock of the needed box" the actual values could be directly calculated. The first one with a list of the full integrated partners that sell through FF; for the second by making a comparison between the boxes that were ordered and the types of boxes that are suggested for that partner. Lastly, by analyzing the amount of exceptions that were created due to a no stock of the recommended box.

⁴ Calculated by= $(1-PA) \times \text{Number of BO}$

For the causes that are related with FF we started with the Production issues: "Not mandatory to fill" are all the products that leave production without a recommendation; "Do not receive the entire product" is a problem for the following categories: Shoes; Sunglasses; Watches that have a rigid box; "Not easy to predict" was applied for the categories Bags; Lifestyle; Hats; Fine Jewellery; Fine Watches because they have very big variability inside the same category and brand; and finally "Make the same mistake repeatedly" was the proportion of products with the same DesignerID and category that suffered the same overwrite correction.

Regarding FF algorithm mistakes, the proportions were calculated as follow: "High variability for the same product" are all the shoe brands that were reported as not fitting all the sizes inside the same box size; "Different Packing techniques" were all the clothes that were sent equally in two different box sizes or products that were created exceptions because the clothing was sent with a hanger; "Wrong recommendation" are all the overwrites that had to be corrected again; "Wrong recommendation showed" are all the products that are sold in a different region than the one they were produced on; "No overwrite done" are all the products that are sold with a recommendation of a box different than an European because only those suffer an overwrite currently; "Production recommendation disappear" are all the items that lost a recommendation after being produced and a box being attributed.

Lastly, to finish this analysis, we needed to have the causes' frequencies in order to determine the proportion of errors assigned to the Partners and FF. Currently, FF's overwrite has an accuracy of 93.1% and covers 73.2% of the sales. Furthermore, the photographic production has an accuracy of 76.4 % and cover 26.8% of the sales. Overall , it can be concluded that FF recommendation has a global accuracy of 88.6%. For the boutique PA the average accuracy is 74.4%, Figure 4.5 represents the distribution of error between these two macro entities.



Figure 4.5: Errors attributed to Farfetch and to the partners

As it is not possible to totally disassociate the different causes for error, the following assumption will be used: the lost of certainty created by the FF's recommendation accuracy will be considered as the companies' fault (drop of 11.4%) and the difference between it and the actual PA will be considered as the boutique's fault (drop of 14.2%). The respective proportion was calculated and the distribution resulted in 44.7%, of the total errors of packaging, caused by FF and 55.3% caused by the partners. In Figure 4.6 the result of the previously discussed rationale to distribute the errors causes can be observed for the main categories. Note that all of these percentages are according to the number of BO's affected.

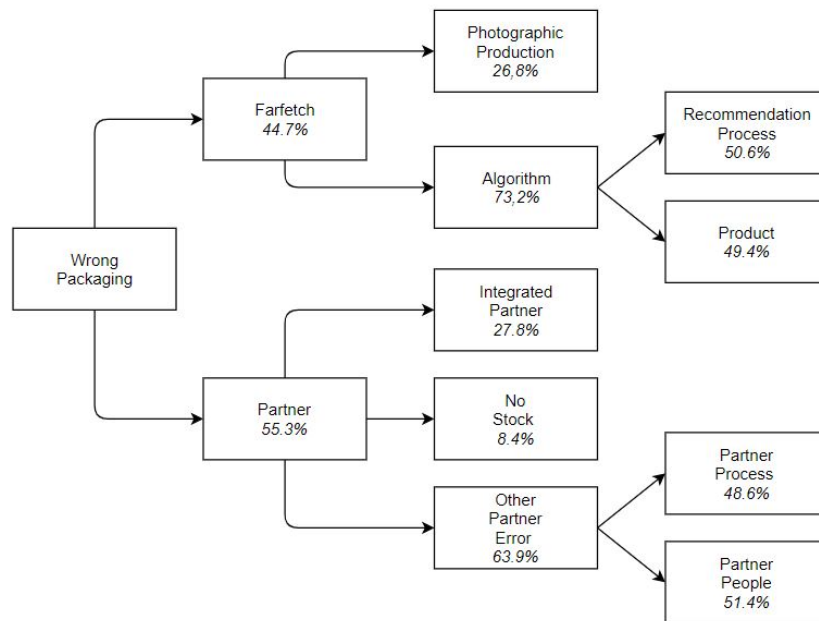


Figure 4.6: Error frequencies distribution for high level categories

Pareto Chart: After defining the number of occurrences for all the mistakes with the methodology mentioned before, it was decided to design a Pareto chart which would help defining in a intuitive and visual way the errors that occur more often and the relative impact that they have in the overall process. In Figure 4.7 it is possible to see the different mistakes weights grouped by the same categories that were presented in the Ishikawa Diagram. In the Appendix E it is possible to observe the detail for all the different errors mentioned before. With this tool it was concluded that there is not a clear Pareto Rule frontier since 40% of the causes induce 80% of the faults, when looking at the FF overall.

Sample adjustment: In order to understand if the sample used for the Partners was adequate to estimate the different causes of errors an adjustment test between the sample and the population's reality was made. According to Zaiantz (2014) this distribution does not follow a normal dispersion because it fails the "Kolmogorov-Smirnov Test for Normality" with a p-value of 0.006786.

After performing the Chi-squared test for goodness of fit, according to Guimarães and Sarsfield Cabral (2010), it confirmed that there is not enough evidence to prove that the sample does not follow the population distribution with an error of 5%. In the Table 4.2 we can see the results of the test and in the Figure 4.8 the population distribution (columns) and the sample distribution (line). The tendency towards worst performing partners is understandable because this project is more focused in increasing low performances than in perfecting processes above target.

This analysis considered that partners with the same average PA (comprised on the intervals presented in Figure 4.8) have the same pains in the process.

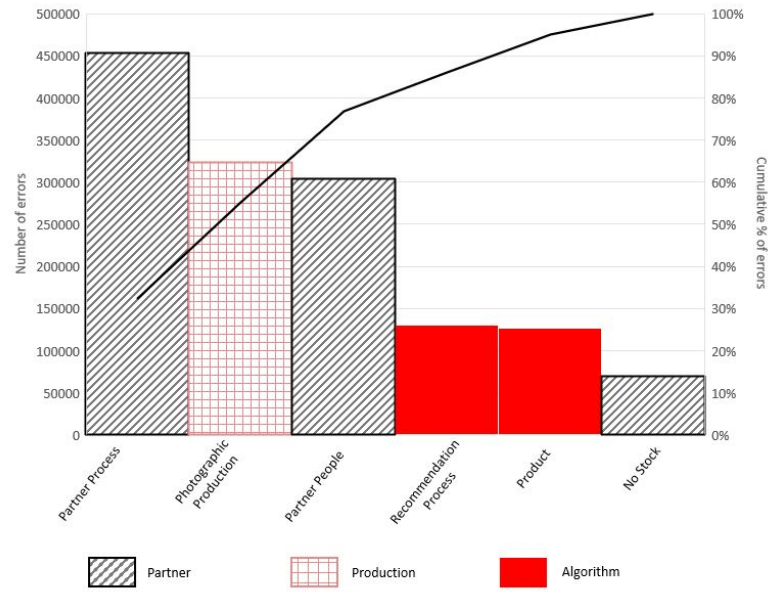


Figure 4.7: Packaging Errors Pareto Chart grouped by High-level categories

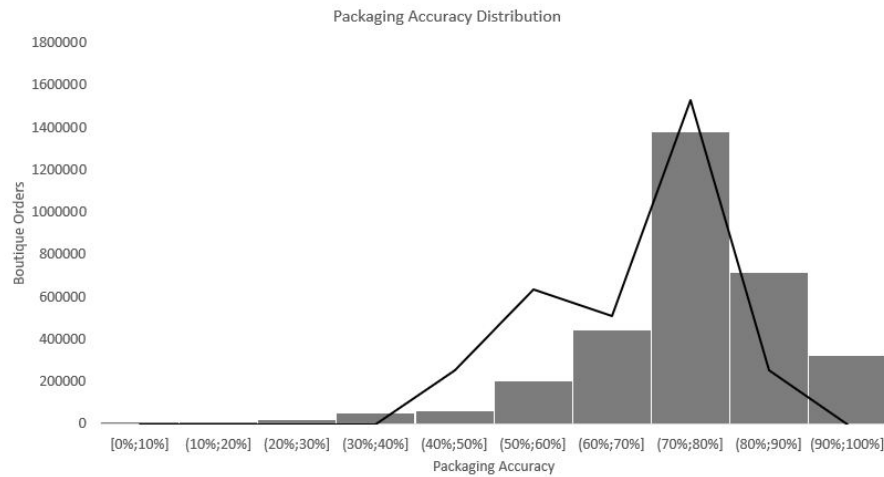


Figure 4.8: Real Packaging Accuracy vs Sample adjustment

4.2.3 Final problem statement

To conclude this stage, it is now possible to understand what are the issues that need to be addressed to solve the packaging accuracy problem. The main causes of error are related with: the difficulty from the stores to adjust their processes to reach this new target (many partners do not have access to the recommendation and those who have it do not provide enough visibility and relevance); and the quality of the recommendation provided. Frequently, photographic production cannot see the entire product and has trouble deciding which box is more appropriate. Lastly, the current algorithm is not able to cope with the large diversity of products that are sold in FF, and is slow to act due to the wait to receive the carrier's receipts.

Table 4.2: Chi-squared adjustment test results

Degrees of Freedom	Error	Chi-square value	p-value
5	0.05	10.59	0.06

4.3 Develop

During this stage we started elaborating possible solutions and opportunities that could help solving the different problems that were collected in the previously, in order to establish a future implementation plan. Now the main goal is to keep options wider, several brainstorm sessions were made to try to solve the various concerns with both team members and partners. The main ideas that resulted from these discussions are a consequence of errors described in Section 4.2.2.

4.3.1 Partner suggestions

Monitor Key Partners

This suggestion occurs as a response to the lack of engagement and misunderstanding of how this new process should work. FF could promote a close motorisation of its top offenders in order to support and create some urgency on the matter. With a close tracking of some key partners it is possible to have a more direct and efficient approach to achieve a better PA and also correct root causes. With this monitoring it also becomes possible to receive feedback and have a closer control of what being implemented.

For this initiative to be successful it is important to take into consideration the best practices to influence the partners. This motorization should be performed out of sales season to avoid overcharging partners with additional work; the benefits that they will obtain should be highlighted; the targets should be realistic and a mutual commitment should be established. The communication relationship that exists between FF and its partners is very peculiar since the structure is apparently of continuous trading, however the power and climate axis are less strong. This indicates that the best approach to promote change is a hybrid between a collaborative and simple market relationship, which consists in communication through targets and requests, transparency and good quality of information.

Dashboard and guidelines to partners

Similarly to what was suggested for the photographic production, a new dashboard should be implemented to show the different partners their results and how they are placed in comparison to the others. Stimulating evolution through competition and self-improvement. Since it is impossible to monitor every partner it is also needed to reinforce that Partner Success starts including this new metric into their monthly routines and also start creating more awareness around the subject. The objective is to create an incentive to change their behaviour through other values than just the monetary. The guidelines that would be presented in this section would be similar to the ones presented before, including print some current examples of categories that always go in the same

box type, encourage managers to make regular training and sensitize employees with a sustainable message to help paying attention to this matter and its advantages.

Print-out the recommendation in other documents

For all of the partners that do not have access to the recommendation neither in Storm nor in the Order Sheet, we should try to insert the recommendation in a document that arrives to the packing station. Partners that are fully integrated or they are in a warehouse it is important to secure that the recommended box is visible in the moment of choosing the box for an order. In some cases, all of the final documents that go inside each order are already printed in the packaging step which would make an easy change to add the box recommendation or even to print it in the AWB of the order.

Provide visibility of suggestion to integrated partners

A more complex, but also more effective solution to the previous one proposed, would be to change the integration that FF currently has with its partners. A full integration that would allow to see the recommended box in the right place. and to grant the opportunity to create exceptions whenever needed as well. The solution that fit different process types and changes it according to our partners requirements. This is a solution that requires a lot of effort in terms of technological development because it does not only depend in FF investment but also on the partner needs to create new features in the warehouse management system.

Forecast box sizes needed

In order to eliminate the issues of boutiques not having the right boxes, FF could provide a box forecast per size to help them deciding which boxes they should order and with which amount. Either because they do not order all the sizes needed or they did not predict the correct assortment for the period, this estimation would help partners to have a better control of the stock they would need. Besides helping to prevent stock errors from happening, it would also simplify the filling of the order packaging form. FF has more data analysis capabilities and knowledge to be able to create this forecast successfully.

4.3.2 Photographic Production Suggestions

Provide a pre-suggestion in production

One of the suggestions made to help the scan-out staff while filling the Packaging field is to provide a pre-suggestion of the most probable box for that product according to historical data or using the ML algorithm mentioned in section 3.3.3. The main objectives of this decision were to avoid empty fields in the box recommendation; make the decision faster, more intuitive and informed and, consequently, increase production packaging accuracy. The idea was to use the different confidence levels according to the data that is provided, complemented by a colour scheme that would make the employee pay more attention to the recommendation according to its shade: if it is green there is a high probability of the suggested box being suitable and red there is less

certainty about the value. This colour scheme is very important since there is a high variability of accuracy level depending on the family category, but also on the level of detail used to create the suggestion. Additionally, another feature could be to delete from the list boxes that are not suitable for that category: for example shoes can never fit in an accessory box, which would facilitate even further the selection and avoid mistakes.

Dashboard and guidelines for Photographic Production

Another suggestion that was proposed, to help production making the best box choice efficiently was to create a dashboard that would help them to keep track of their performance. This dashboard would be composed of: KPIs discriminated by category of items and box sizes; employees conduct to show which types of items have a worst accuracy. For the more specific guidelines they would include: regular training for new employees, creation of routines to evaluate performance, always have a visual reference of all the boxes folded and labeled and lastly draw the different sizes boxes in the folding stand to help quickly understanding in which box the item fits the best. Again this would reduce the wrong recommendations given, reduce repeated mistakes and make employees learn from them.

Predict recommended box

This suggestion is more disruptive since it would have a bigger impact in the unroll of the process. The baseline of this idea is that FF should be able to predict the most adequate box for each item without the help of production. If the accuracy of this algorithm is better than the production, this step could be taken out of the scan-out responsibilities. One way to achieve this can be to take the current machine learning algorithm that was previously developed and have it take into consideration more variables. One of the suggestions is to start having the box measurements of the products that have a rigid box. For the partners that already take measurements of the different sizes, to put it on the website, they should also start recording three additional measurements of the brand boxes. This is valuable information to predict a better recommendation where the box can fit and that production does not have access to. This will be the first version of the algorithm.

Estimate of Folding Volume: Another variable that could also be taken into consideration in the algorithm mentioned in section is the actual measures of the clothes themselves. In another FF project it is being developed a new and more standardized process of taking the measurements for the different categories of items. Once these measures have a standardized procedure it could also be possible to develop a prediction of the box volume for each of the piece and have this as an extra variable in the algorithm. This will be the second version of the algorithm, which has the boxes' sizes and predicts the volumes.

4.3.3 Algorithm suggestions

Increase range and frequency of algorithm performance

With this objective, there are two main goals: increase the range of sales that are being evaluated by the algorithm and start performing an overwrite more often. Requiring five orders for

each *DesignerID* is too high for the diversity of products that are sold at FF, resulting in the sales coverage of only 73% of orders. The suggestion is to decrease the threshold for only 2 sales per *DesignerID*, since we only need to have 2 smaller boxes to change the recommendation after 5 orders there is no justification why it should wait for 3 more. With this measure, we would help reducing even more the number of sales evaluated with the production recommendation and more products would be eligible for correction. Another alternative to start evaluating more orders would be to overcome some of the limitations mentioned in Section 3.3.1, such as starting to gather the detailed information per order of other carriers.

As mentioned in Section 3.7.4 one overwrite every 2 weeks is not frequent enough and the fact that it is a manual process does not allow to increase its occurrences. Having the overwrite happening so scarcely only makes the wrong information to be shown longer. By automatizing this process and change the recommended box as soon as a new suggestion is calculated it would be possible to correct the recommendation faster rather because it is wrong or it does not exist.

Eliminate the different box sets

The current different box systems that exist only bring complexity to the structure and no benefits. Since the different boxes only reduce the effectiveness of the algorithm and create bugs that result in a wrong recommendation being shown to the boutique, an easy solution would be to standardize all boxes in an universal system. With this solution we would eliminate these inconsistencies and remove complexity, while increasing the algorithm accuracy, consolidate suppliers and save money from scalability which seems a very appealing alternative.

Other packaging alternatives

To help reducing the amount of air that is transported by the carriers other alternatives of packaging could be explored. Not all packing materials are cardboard boxes in the e-commerce market. Another very common option are paper and plastic bags that contain the product. This is a way to drastically reduce the amount of air because bags adjust themselves much better to the product configuration. In this solution there are some concerns about the customer satisfaction receiving the items in a format that is perceived as less luxurious. However, it is still a very powerful alternative: partners would save time by not having to fold the boxes; and it would reduce complexity by having less sizes to choose from.

4.3.4 Matrix Effort versus Impact

To be able to compare the different initiatives, we needed to create a method that would allow us to understand which ones would bring a larger impact to the growth of the Packaging Accuracy metric. For that end, an effort versus impact matrix was created. The criteria to calculate the effort was: number of FF teams involved to make the development; budget required; development effort (number of hours spent to deliver) and maturity of the initiative (it was considered that those with a higher maturity level would require more effort to obtain incremental gains). To calculate the impact for FF in savings on shipping costs, an estimation based on data from last year oscillations

of PA was made. Afterwards, each action was associated with the errors that it would solve (or part of them).

In Figure 4.9 it is possible to see the result of the analysis where the effort is a score attributed to each initiative according to the variables mentioned before. Each impact is calculated through the Formula (4.1), where the constant value is the already mentioned estimation and the Δ is the variation in percentage points (p.p) that the initiative will provoke. All impacts were calculated taking into consideration that each initiative could be implemented independently.

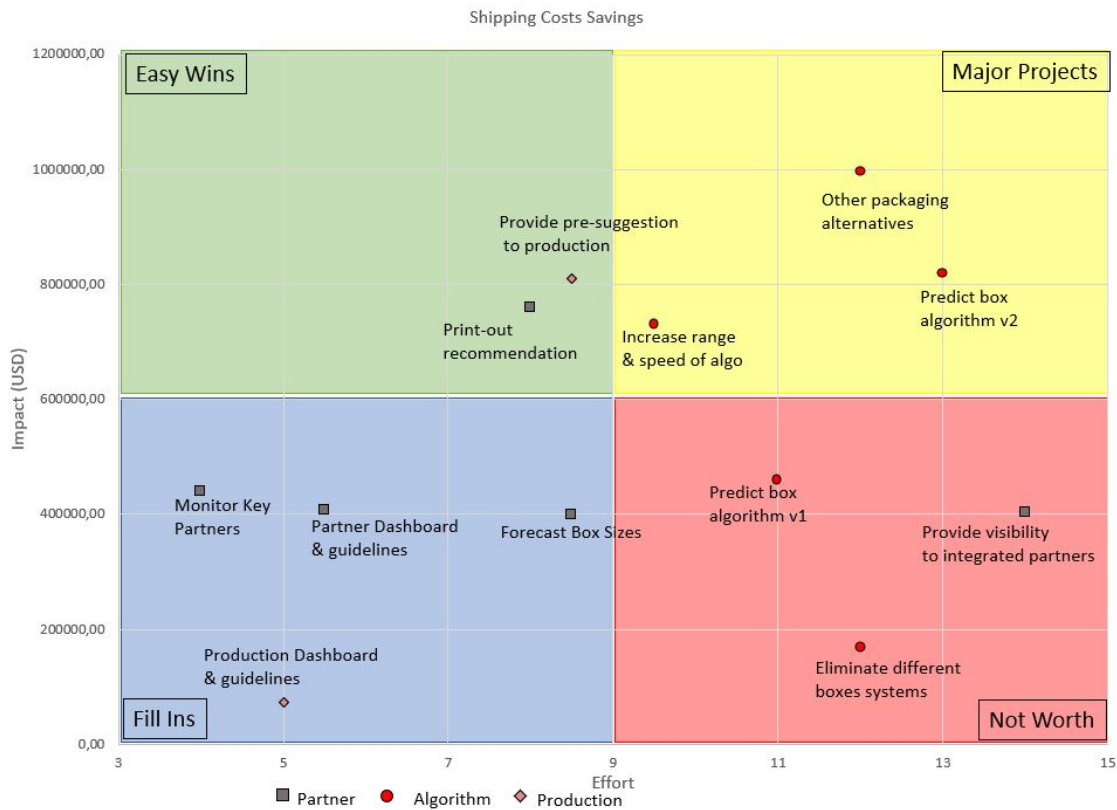


Figure 4.9: Matrix of Impact-Effort for the initiatives

$$\text{Shipping costs savings} = \text{Current shipping costs} * 0.205\% * \Delta \text{ Packaging Accuracy (p.p.)} \quad (4.1)$$

From this matrix we can observe that both dashboards and guidelines have a low effort which could make them appealing to implement even if they have a lower impact (the production's impact is lower because the percentage of sales affected by them is small; the level of maturity is higher which increases the effort to obtain the pretended results). To print-out the recommendation in other documents is also appealing since we would be giving visibility of FF recommendation to our most important partners, with a medium level effort. Surprisingly, to provide a pre-suggestion in recommendation would have a big impact, the amount of sales that do not have any box associated would reduce from 15% to around 1% (which are the items that do not fit in any of the boxes).

From this matrix, the action that has the higher impact is testing out new packaging alternatives, shifting from boxes to bags would create a packaging that could adequate itself to the product size. However, it is not certain that the estimate calculated is applicable in this scenario, further investigation about this alternative should be conducted to validate if these savings predicted are realistic. Out of all the initiatives listed, the only ones that were perceived as not profitable, at least at the current moment, would be: to eliminate the different packaging sets and create full integrations that could provide the recommended box to be seen directly in the different systems used by each warehouse. Both require a big effort (including supplier negotiations and partner investment) and bring small benefit.

In the next chapter an implementation plan will be presented that will take into account the effort required, but also the measures that need to be taken place, in order to achieve targets.

4.3.5 Customer Experience

All of these initiatives will have an impact not only in the shipping costs. It is expected that the customer experience also increases. Taking into consideration around 48 000 orders, in Figure 4.10 we can observe that for higher average Packaging Accuracy values the Packaging Ratings attributed in the NPS ⁵ (Net-Promoter-Score) survey, that is sent after each order, is also higher. Additionally, there is a direct correlation that for higher Packaging Rating values the NPS score also increases, which indicates that for higher PA it is expected to better customer experiences.

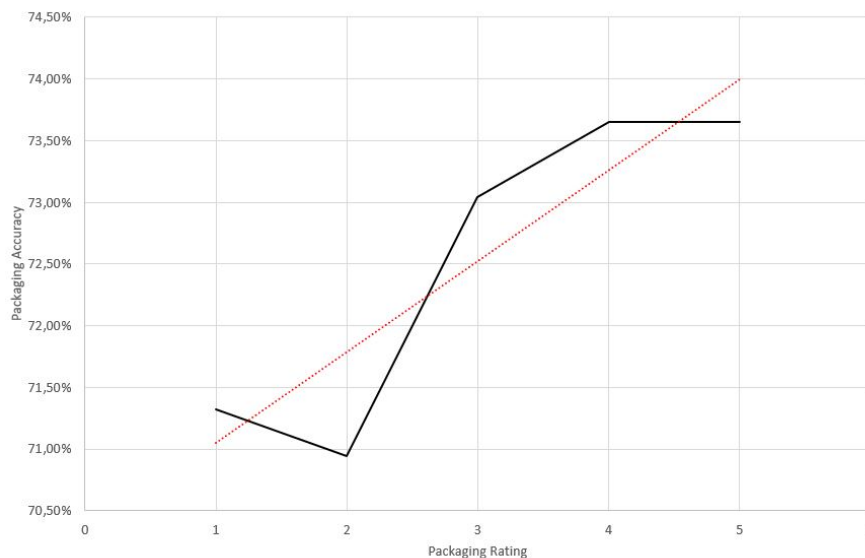


Figure 4.10: Packaging Accuracy according to the Packaging Rating given

⁵ = % Promoters (score between 9 and 10) - % Detractors (score between 0 and 6)

4.3.6 Environmental Impact

The last motivation that was not mentioned yet is the environmental impact that the increase on PA will trigger. From Figure 4.11 one conclude that when the PA increases, the average volumetric weight per order tends to decrease. For example, over the last year FF was responsible for the emission of 3,886,683 kg. CO_2 ⁶. If the PA increases to the target of 85%, around 413,734 kg. CO_2 emissions would be saved, which is equivalent to 90 cars riding over an entire year. This improvement would be accountable for a reduction of 10,6% of the current emissions.

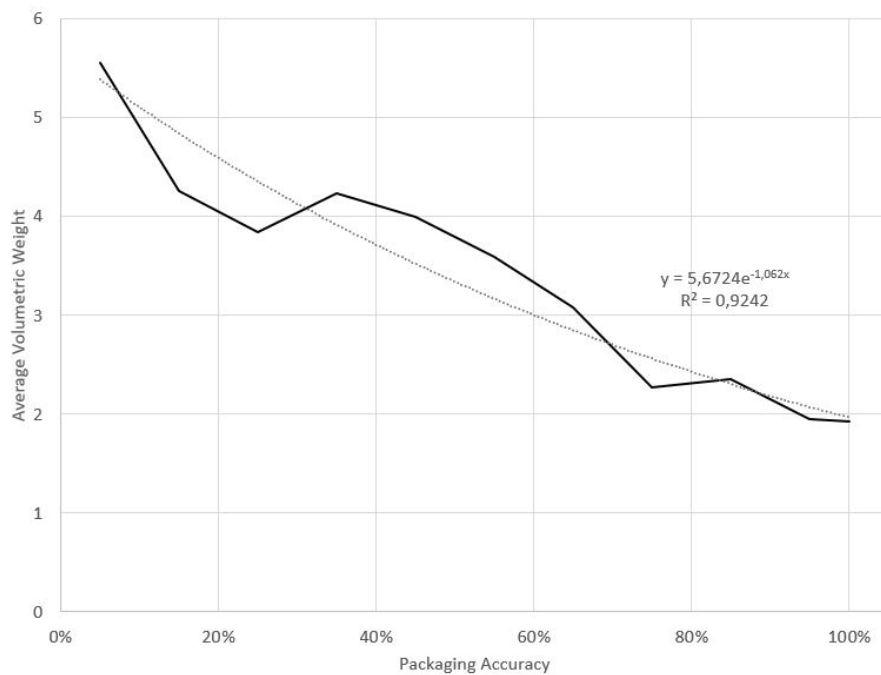


Figure 4.11: Average volumetric weight for different levels of Packaging Accuracy

⁶Source: DHL carbon calculator

Chapter 5

Results

The last step of the methodology for this project is the Delivery Stage, where a subset of the different ideas explored before should be selected to foster a concrete implementation plan that would drive and construct a successful outcome. Also in this chapter the result of some tests that were performed will be presented as a pilot of the consequences that could occur if the solution is scaled worldwide.

5.1 Deliver

The major deliverable from this stage is an implementation plan that will be composed by the different actions, requirements deadlines and expected improvements. In Figure 5.1 it is possible to observe the different initiatives that are to be developed in each step, and the respective PA increase outcome, calculated similarly to the methodology described in section 4.3.1.

5.1.1 Implementation Plan

The implementation plan comprises four stages, that are detailed in turn in the following:

Stage 1: In this first moment of the plan, the main objective is to achieve results as fast as possible; consequently, all the initiatives that had the lowest implementation effort were clustered together. Ideally the order of the effort-impact matrix should have been followed and the initiatives present in the "Quick-Wins" quadrant should be performed first. Unfortunately, due to the short period in which took place this dissertation and with the other teams road-maps already established for the year, it was not possible to follow this rule and be able to present results.

For the dashboard and guidelines of production the main requirements are: to have the engineering process team of the PCs aligned with the changes proposed to avoid resistance to change. Since this is a process controlled by FF, the implementation should not create many difficulties to have employees following the new guidelines. The main deliverables would be to design and share an intuitive dashboard (extract in Figure F.2); to implement regular control on the metric and to stimulate routines where this topic is approached, doubts shared and results discussed.

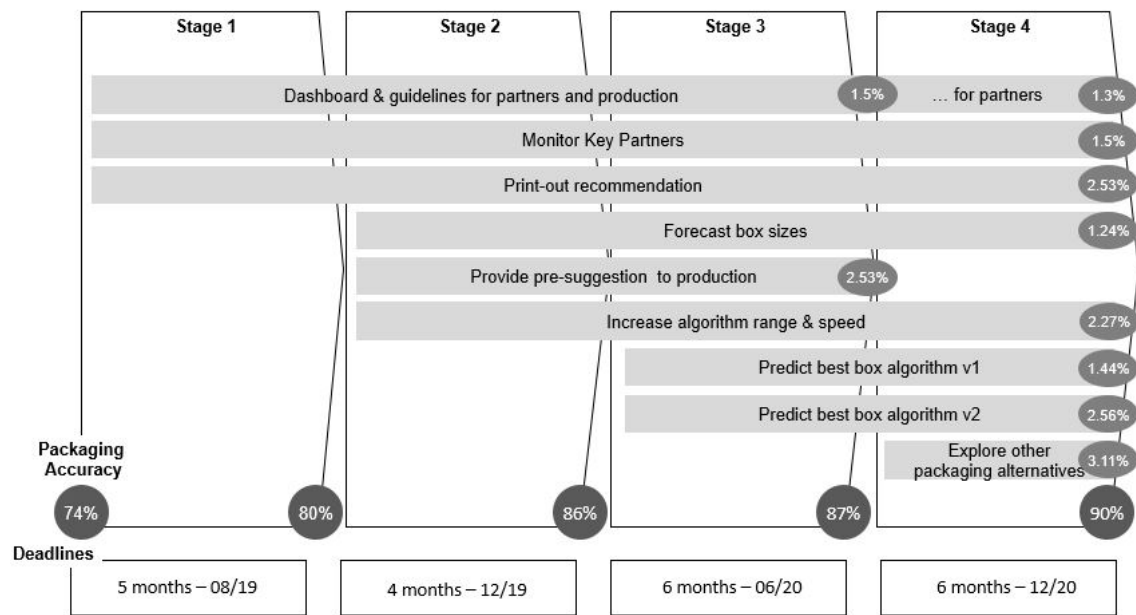


Figure 5.1: Implementation plan stages

Dashboard and guidelines for partners would again require to create a dashboard (extract in Figure F.1), to change routines of Partner Success team and to guarantee that the information is uniform to what is being reported by finance in their financial report in order to guarantee a coherent message. For the guidelines, at this moment, they are being personally suggested, however due to the high number of partners, the main deliverables should be an "one-pager" that could be printed and placed in each packing station, a tutorial video useful for training purposes, a packaging induction presentation that could be presented to new partners as well as a set of instructions and best-practices to make the packing step more efficient, without neglecting the packaging accuracy level.

To monitor key partner, the main requirements are to conquer the selected boutiques engagement on the topic and to stimulate change in their current order processing process. This is a solution with a limited range of partners affected because of the high workload that it generates.

Print-out recommendation has as condition to understand which documents are present at the packing station, if any, to discuss where would be the most adequate place to add our recommendation. Together with this new integration it is also important to guarantee a clear communication with the boutiques to secure that the appropriate training is made to the packing staff so that they check the recommendation before making the box decision. This step is expected to be concluded at the end of 08/19 and the foreseen increase of the overall PA is of 5.5%, which would result in a PA of 79.9%.

Stage 2: During this stage, all of the previously implemented initiatives will stay active. Here, three additional improvements will be concretized.

Forecast of boxes will imply start having a forecast of which products will be sold in order

to know which boxes should be ordered for the next month. However, if the assortment of boxes needed is similar from season year-over-year (YoY) a less precise forecast could be provided in the short term that would mainly work as a tool to encourage partners to order all the needed box sizes.

Provide pre-suggestion would require to decide the method that would be used to suggest the best box, rather the current machine learning algorithm or based on historical data. This initiative already demands more technological development and training to the staff that would have to fill this field in a different way. The main deliverable would be a new button with the suggested boxes in the scan-out page that would allow the employee to click directly, instead of scrolling in a combo box.

To increase the algorithm range it needs to be guaranteed that by reducing the threshold to only 2 order per *DesignerID* the algorithm will not reduce its accuracy as well as instability. To speed the overwrite process, it should be automated. Here, it is fundamental to secure that the code is consistently written and has no bugs, once the process is automated there will not be a manual check that currently also has a quality control function.

At the end of this step the new accuracy is expected to be around 86.0% which is slightly above the target, but there are still many opportunities of improvement that can be explored and that would bring additional value. It is expected for this stage to be over at the end of 2019.

Stage 3: To make the implementation of the predictive algorithm it would require to change the process. Additionally, this step requires other projects that are currently ongoing on the company to advance in order to start gathering the data for it to be examined and plotted as new variable to be considered in the ML algorithm. The first requirement is then to guarantee that we are able to collect the data needed to proceed with the development effort. One of the conclusions made is that this process change is not worth it for the first version with only the shoe boxes measurements taken into account because its release would result in a decrease of PA. The change in the process should only occur when both versions are ready to launch since they complement each other. This stage should be over until 06/2020.

Stage 4: To make the try out of using bags instead of boxes it is necessary to understand which products are adequate to this new packaging in order not to increase the level of damaged items. Another requirement is to guarantee that partners use this type of packaging when adequate and that they are willing to increase the current complexity of their box assortments. A test experiment to understand if the estimate made is accurate or not is also necessary, in order to have a higher confidence that the implementation of the new packaging is worth the effort. This stage should be over until 12/2020.

Monitoring & Control: Throughout this entire implementation plan it is fundamental to keep comparing if the expected results are matching with reality in terms of PA increasing. Since this is a long project it is also needed to check if all of the different teams are engaged with providing

results and keeping the timeline. Lastly, new continuous upgrade opportunities might be identified so some rectifications can be applied to readjust the plan.

Risk Analysis: The major risk of the different stages is for the impact of each initiative to be lower than expected. The disbelief that the PA suffered over the last year maybe will have a bigger impact than the one initially accessed. Another important risk is that in case the development effort is higher than expected, the project can suffer from delays and higher budget than foreseen.

5.2 Final Results Savings Prediction

Through the different stages of the project we are able to predict the evolution of savings in shipping costs from the increase in PA. In Figure 5.2, we can observe the increase of PA as improvements we being implemented. Note also that in 2020 the absolute increase of PA is much lower because as the project progresses, more effort is needed to improve the process.

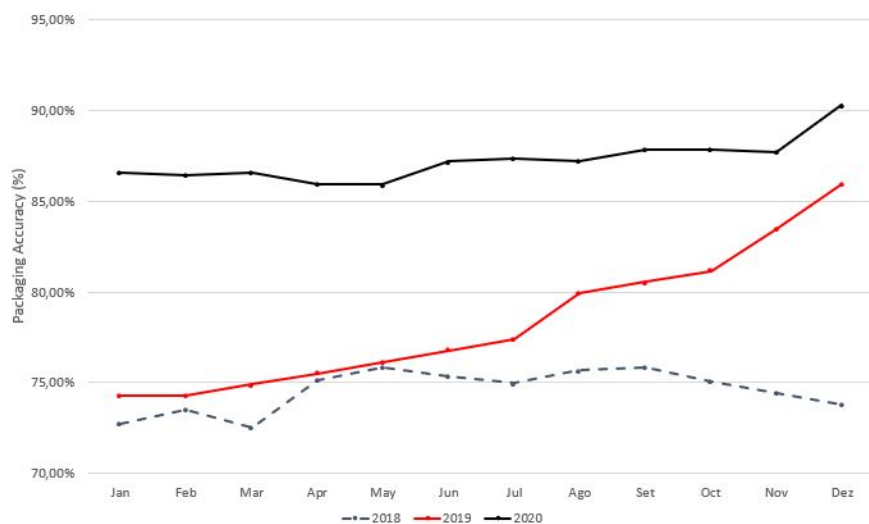


Figure 5.2: Expected increasing of PA of the project

In Figure 5.3 it is possible to observe the expected saving caused by the increase of Packaging Accuracy when comparing to 2018. The cumulative of all the savings obtained will be accountable for a reduction of 4.4% of the current baseline.

5.3 Production Accuracy Pilot Results

After introducing the sizes of the different boxes drawn in the Scan-out table at the end of February it was possible to observe that there is a big increase between the pilot table and the remaining ones as showed in Figure 5.4. Even though this results only take into consideration the European production center in Guimarães an average increase of 10 percentage points was a even

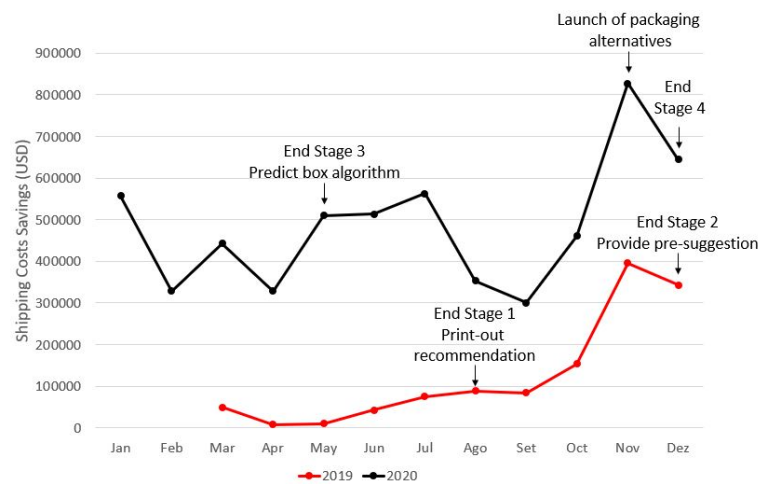


Figure 5.3: Expected shipping savings of the project

higher improvement than initially expected. From the pilot trial a 4,500USD was already obtained over the past three months.

This promising results observed with this pilot are an encouragement to implement this technique in the remaining stations. However, when workload in production is higher the PA still decreases indicating that even with this initiative there is still opportunity to improve this process further.

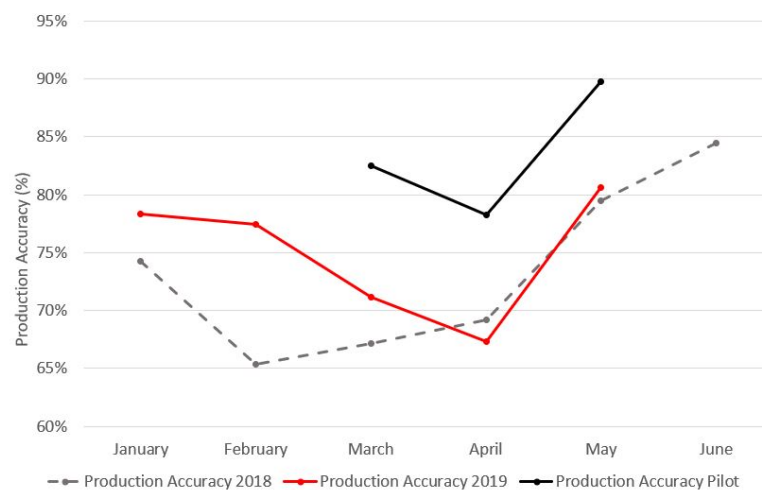


Figure 5.4: Production Packaging Accuracy Evolution

5.4 Partner Monitorization Results

From the prior assessment made in Section 4.1, 15 partners were selected to be monitored more closely. Here, the results of two success cases are presented: in Figure 5.5 one can observe

the performance of a low score store; the best score ever reached was after the monitorization started and there has been a constant better performance than in 2018.

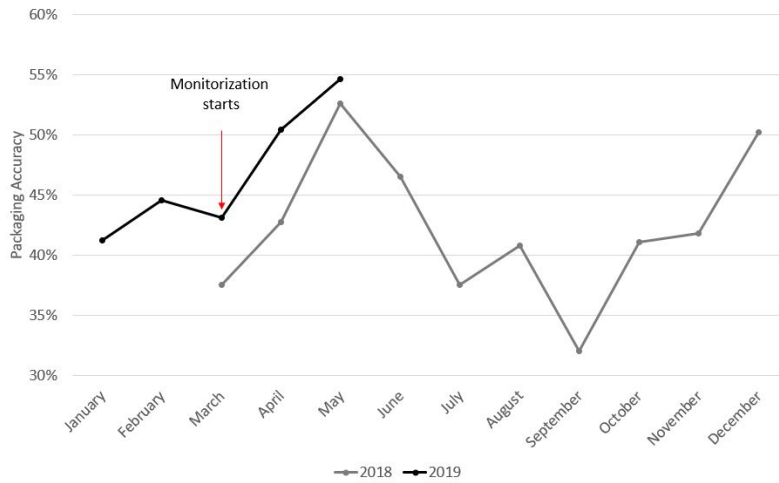


Figure 5.5: Packaging Accuracy of low performing partner

In Figure 5.6 one can observe that for a better performing partner it was also possible to obtain higher packaging accuracy levels and to see improvements. Since the monitorization started it was possible to accomplish permanent growth, unlike in 2018 where the accuracy was declining during the same period.

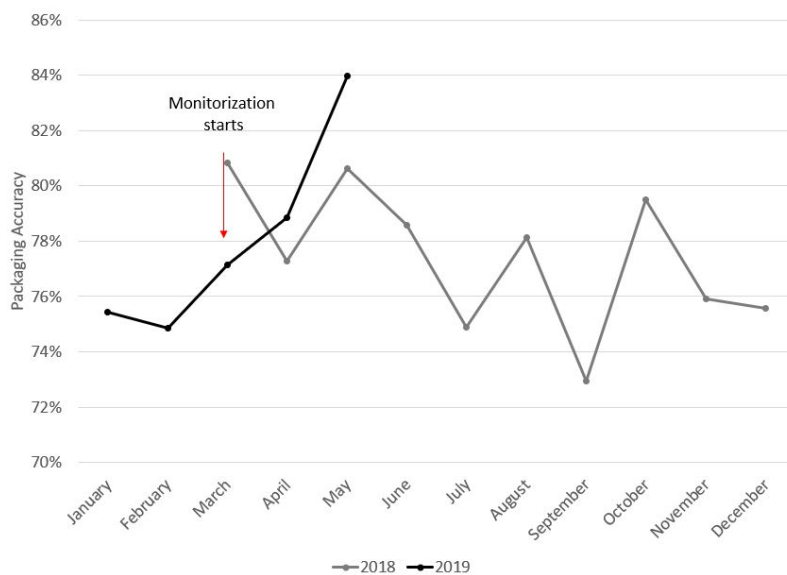


Figure 5.6: Packaging Accuracy of average performing partner

From the 7 partners who positively responded to the motorization and recommendations a saving of 22.150USD was already retrieved over the past three months.

Chapter 6

Conclusion

6.1 Project Conclusions

This dissertation focused on the different challenges that Farfetch is currently facing regarding all the excessive packaging that is being transported. This concern results in a waste of money and resources that add no value to the customer (only 74.4% of the orders were sent in the correct box). However, the path on how to overcome it was not clear. Initiatives to try to solve this problem during 2018 were already launched but the results were not as positive as expected. After an initial effort, made by the partners, to choose the smallest box possible, which resulted in an uplift of 4% of the Packaging accuracy, managers started losing interest and commitment, which led the values of performance to return back to where they were before the incentive was introduced.

This project's main objectives were to understand the reasons why previous initiatives did not reach the expected promising results, understand what were the causes for the mistakes to occur (the monetary incentive was not enough to make them correct their process) and propose a solution that will make partners committed and result in minimising shipping costs.

Planning the approach with the different stakeholders was crucial due to the different teams that were involved throughout the project. For instance, Partner Success was responsible to schedule the meetings with the different partners to help us understand what are their pains and difficulties to follow the packaging recommendation. Engineering Process had to help implementing the different box sizes drawn in the stations, guarantee that workers were using it and calculating the impacts both in time and in Packaging Accuracy.

Due to the lack of control that exists in Farfetch regarding the operational process that the partners carry, one of the difficulties faced during the initial assessment was to transmit a supportive message instead of an intrusive one. Make them understand that their feedback was important for us to improve the current process was fundamental to guarantee good quality information.

After completing the analysis of the different limitations, both for Farfetch and for Partners, ideas started to be designed to solve the different errors that were identified. For the main suggestions the expected impact was calculated and a prioritization was made according to their financial returns, development effort and increase in Packaging Accuracy. Hence, an implementation plan

was established and deadlines settled. From the first results observed, we could already take some positive results that now need to be escalated to the entire Farfetch system. From the pilot trial developed by this project a 4,500USD was already obtained over the past three months. Furthermore, from the 7 partners who positively responded to the motorization and recommendations a saving of 22.150USD was retrieved. These 26,650USD come to consolidate the promising massive saving expectations.

Summing up, this project is presenting very promising results, however the implementation of the different initiatives has just started and there is still a lot of development that needs to be done. It is essential to follow the different stages status and guarantee that the outcomes are according to the expectations, otherwise some adjustments might have to be done. The path is traced but it needs to be followed in order to accomplish the targets Farfetch proposed for this project - 85% overall of Packaging Accuracy.

6.2 Future Projects

Continuous improvement is an ongoing process that stimulates the permanent aim to keep reducing costs and increasing quality. As a consequence of this mindset, during the course of the project and perhaps due to the increase of knowledge about the topic, other opportunities were identified that could be promising for the company and should be further explored. Additionally, having a very high PA does not guarantee that there is no air being shipped and that there are no more opportunities to reduce shipping costs, it is just an indicator that partners are trying to follow the smallest possible box from the alternatives that they are provided with.

6.2.1 New Box Sizes

One of the variables that was considered fixed during the entire project was the assortment and sizes of the existing FF packaging sets. These sizes have been used for ten years while the assortment of items sold at the Farfetch website has increased dramatically. Even though adding more boxes can add complexity to the supply chain there are two perspectives that have never been explored regarding box sizes: the first is try to adequate the box to the carriers thresholds, obtaining box sizes that are smarter and use the maximum volume possible; the other analysis is to try to find some in between sizes that would make some products shift to a smaller box. Lastly, create some boxes that would be more adequate for some specific categories, that currently do not have any appropriate box like watches and jewellery. As can be observed in Figure 6.1 some specific partners could reduce the number of boxes they currently own and the amount of unused space shipped if the boxes were more adequate to their products needs.

6.2.2 New Delivery Option

In case it is verified that the bags option discussed in Section 4.3 indeed decreases the customer satisfaction because it is not considered a luxury experience, new delivery options could also be



Figure 6.1: Correct Box used with high volume of air shipped

developed like:

Green Shipping Option: For products that would not be damaged for travelling in a bag instead of a box, clients would have the option during check-out to choose this new alternative. In case customers prefer to not have an elegant box but instead have a less impactful carbon foot print delivery they could select this option. With this alternative, Farfetch would make the clients have the power to choose a bag instead of a box which wouldn't have any negative impact in customer experience. Additionally, by offering the customer the possibility to make a conscientious decision about the topic, it would encourage them to select this more sustainable alternative that would be more profitable for FF.

Bags for returns: In this alternative bags with the returning shipping label on would be putted inside each box just for the return. A deeper analysis needs to be made in terms of costs of duplicating the packaging, increase of the shipping costs by carrying extra weight and assess the difference between the waste of producing extra material compared to the carbon dioxide emissions saved for reducing the shipped volume. Customer inquiries should also be handled to understand if this initiative wouldn't be perceived as more wasteful than the current delivery. After this analysis if it is perceived as profitable alternative this option could be implemented for certain items that would not suffer any damage.

6.2.3 Box Bar Codes

To eliminate all the packaging current evaluation limitations that exist due to the dependency that Farfetch has on its carriers and also to eliminate the one month gap that exists until the invoice information is received, an alternative would be to place an unique bar code in each box that would tell immediately which box was selected for the specific order. This option would require a significant investment and a deeper knowledge about its feasibility. It would require development in STORM to make it read a bar code in step 3 that would mean the packaging step advance

automatically; it would imply to invest in bar code readers for all the partners to have at their packing station and would have impact in the order processing process that currently exists in some partners that don't follow our suggested sequence. A more in-depth study must be conducted to assess the implementation profit, balancing the costs and the expected savings offered by this decision.

6.2.4 Other non-monetary incentives

As keeping commitment solely on awareness with a low impact incentive is still a risk to loose efficiency over time; other motivation techniques should be implemented such as offering free Instagram posts rewarding the most sustainable partner of the month. The criteria to choose this partner can be complex because only using PA to decide the best partner of the month can be perceived as unfair. Many partners already have a very high accuracy as a result of lower diversity of items or the opportunity to create many exceptions due to low volume of sales. Especially after the different stages of implementation are finished and the average Packaging Accuracy grows, the difference between partners will become even smaller. It would be discriminatory to have such a big compensation for such a little variation. Other evaluation parameters should be considered to create this award in order to promote differentiation and diversification for the rewarded.

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Appendix A

RoW Packaging Dimensions and Characteristics

Table A.1: Packages names and respective sizes in centimeters

Box Number	Box Name	Dimensions (cm)	Exact Volumetric Weight (cm ³)
Box 15	Accessories/Jewellery	22.5*10*14	0.63
Box 16	T-Shirt	38*28*3	0.64
Box 17	Clothing	38*28*7	1.49
Box 3	Shoes	36*23*14	2.32
Box 5	Clothing/Boots	35*30*14	2.94
Box 6	Double Shoe	37*45*15	4.995
Box 7	Large Clothing	55*45*13	6.44
Box 13	Boots	70*40*15	8.4
Box 14	Large Boots	60*45*25	13.5

Appendix B

Volumetric Weight Intervals and Formula

Carriers can charge Farfetch by two methods: Weight or Volume. In order to be able to compare both dimensions the Volumetric Weight is calculated with Formula (B.1) and the highest measure between Weight and Volumetric Weight is credited.

For RoW boxes, in case the order is charged by volume, this is the range of intervals in cm^3 used to define which box was used by the partner and if they using our suggestion or not.

Table B.1: Thresholds intervals by box

Box	Express	Standard
15 or 16	]0.5;1]	]0;1]
17	]1;2]	]1;2]
3	]2;3]	]2;3]
5	]3;4]	]3;4]
6	]4.5;6]	]4;6]
7	]6;7.5]	]6;7]
13	]8;9.5]	]8;10]
14	]13;15]	]13;15]
Null	Other	Other

B.1: Volumetric Weight Formula

$$VolumetricWeight = \frac{l * h * w}{5000}; \quad [cm^3] \quad \begin{array}{l} l - \text{length} \\ h - \text{height} \\ w - \text{width} \end{array} \quad (B.1)$$

Appendix C

Machine Learning Algorithm Specifications

Table C.1: Machine Learning Algorithm Accuracy Results

Level	Name	# Products	%	Accuracy (level 0)
0	DesignerID	30132	8.5%	100%
1	BFC_G_SY	188355	53.1%	75.3%
2	BFC_G_S	54380	15.3%	74.6%
3	BFC_G	20889	5.9%	73.7%
4	BFC	5028	1.4%	72.7%
5	FC	55899	15.8%	64.5%

Note that the accuracy percentages are all calculated in comparison with the results of level 0.
The caption of the table is as follows:

FC	Family Category
BFC	Brand Family Category
BFC_G	Brand Family Category Gender
BFC_G_S	Brand Family Category Gender Season
BFC_G_SY	Brand Family Category Gender Season Year

Appendix D

Discover Stage of Packaging Project

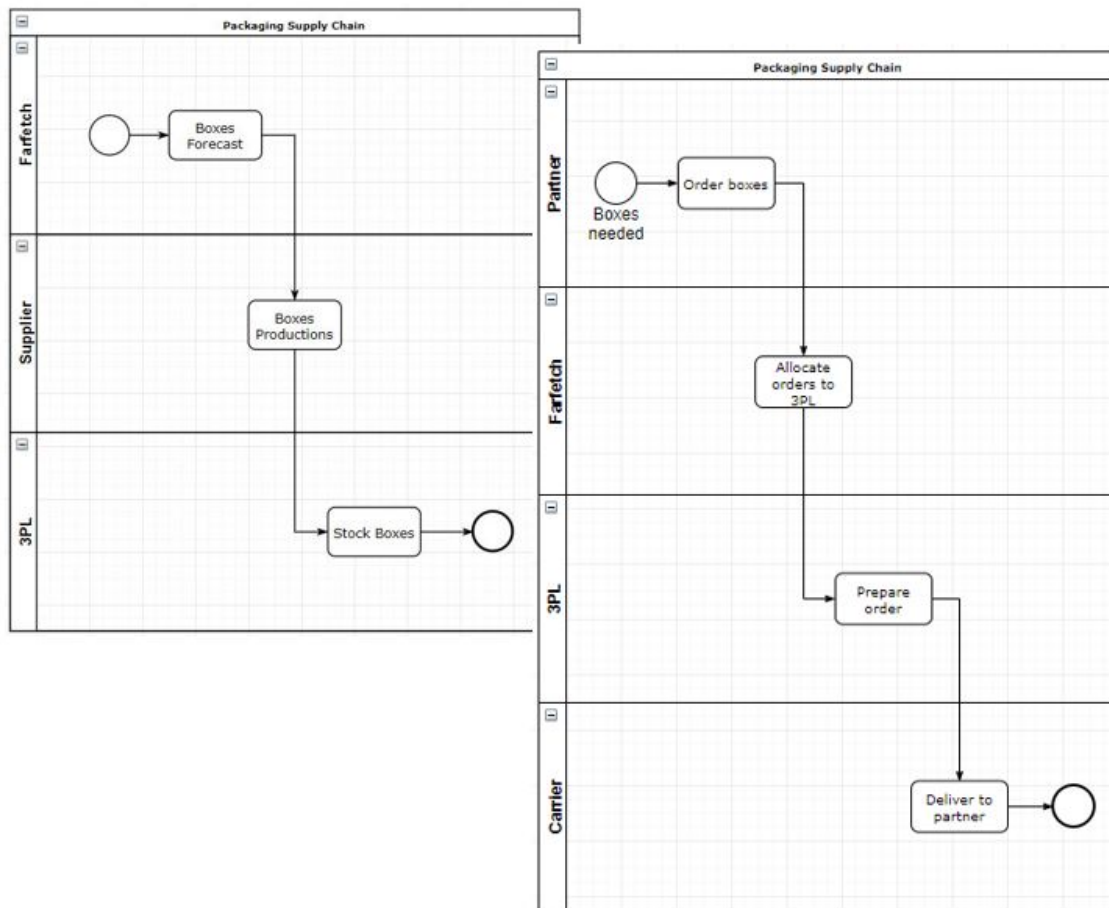


Figure D.1: Farfetch Packaging Supply Chain

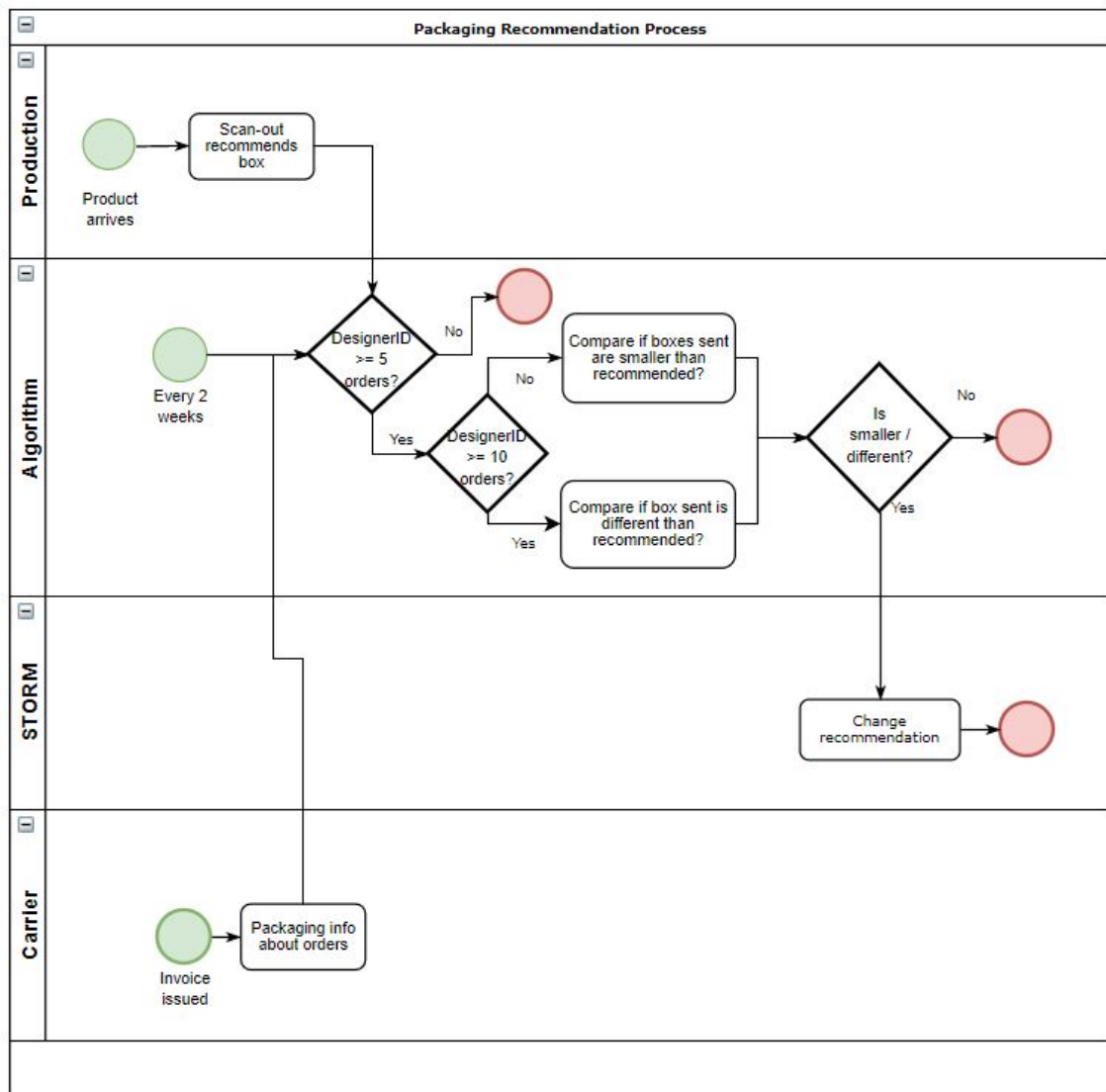


Figure D.2: Packaging Recommendation process

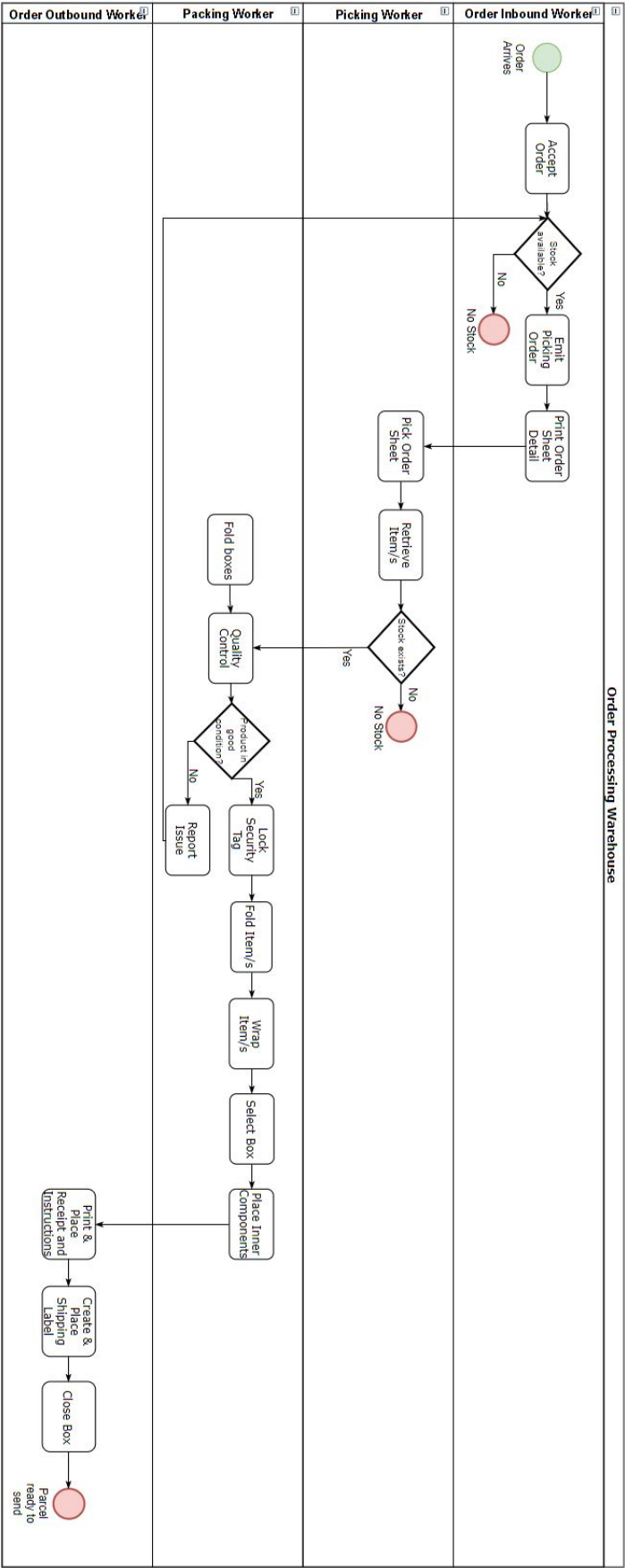


Figure D.3: Order Processing Process in a Warehouse

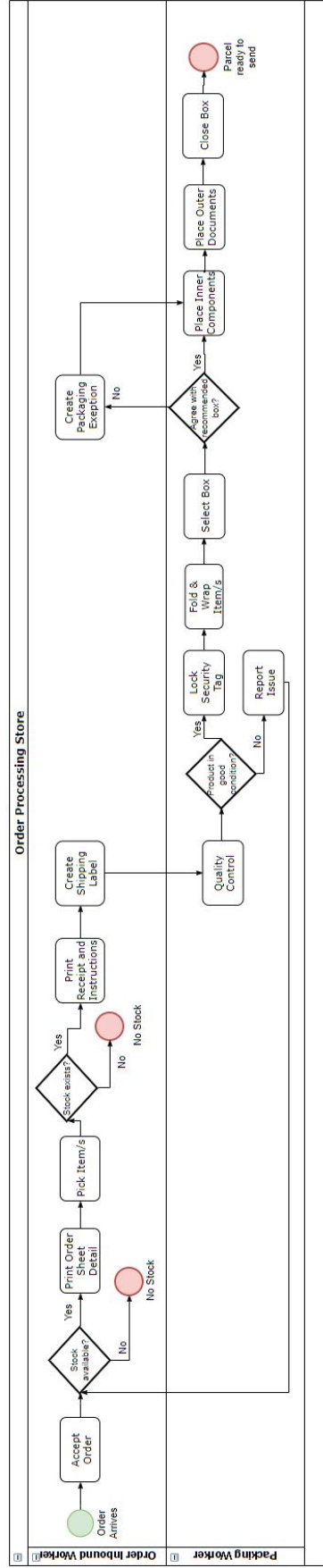


Figure D.4: Order Processing process in a Store

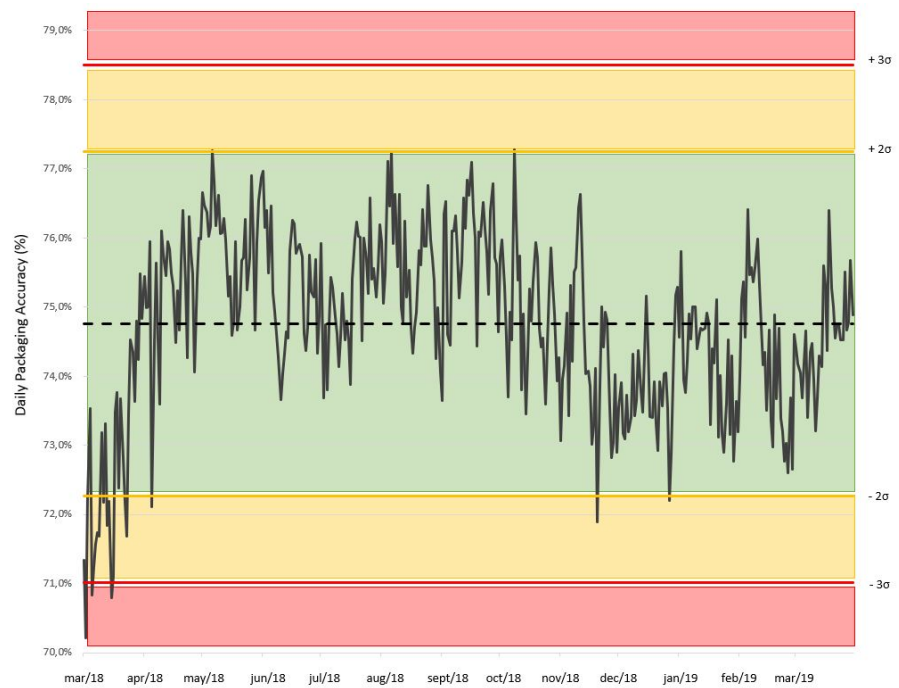


Figure D.5: Farfetch Packaging Control Chart

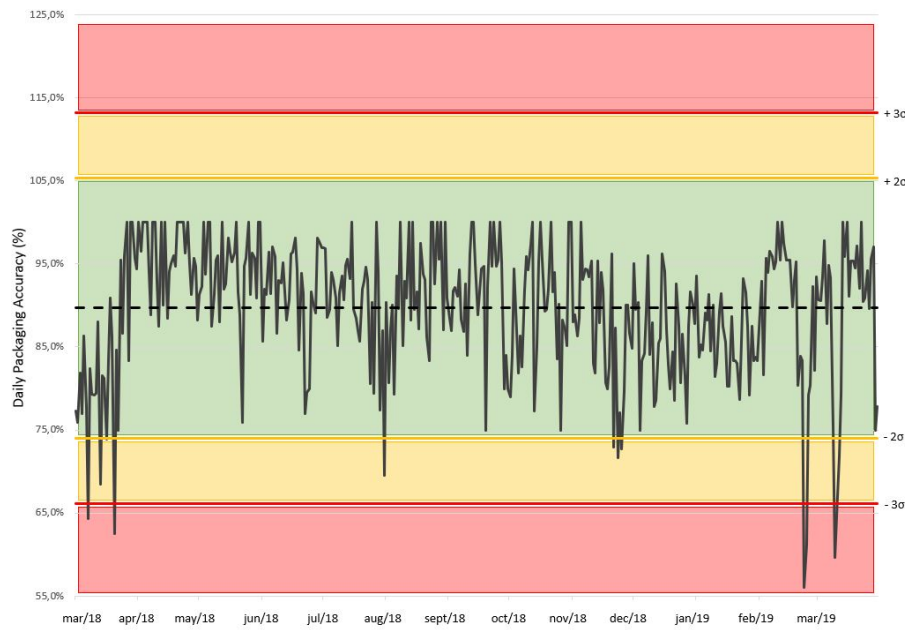


Figure D.6: Well Performing Partner Packaging Accuracy Control Chart

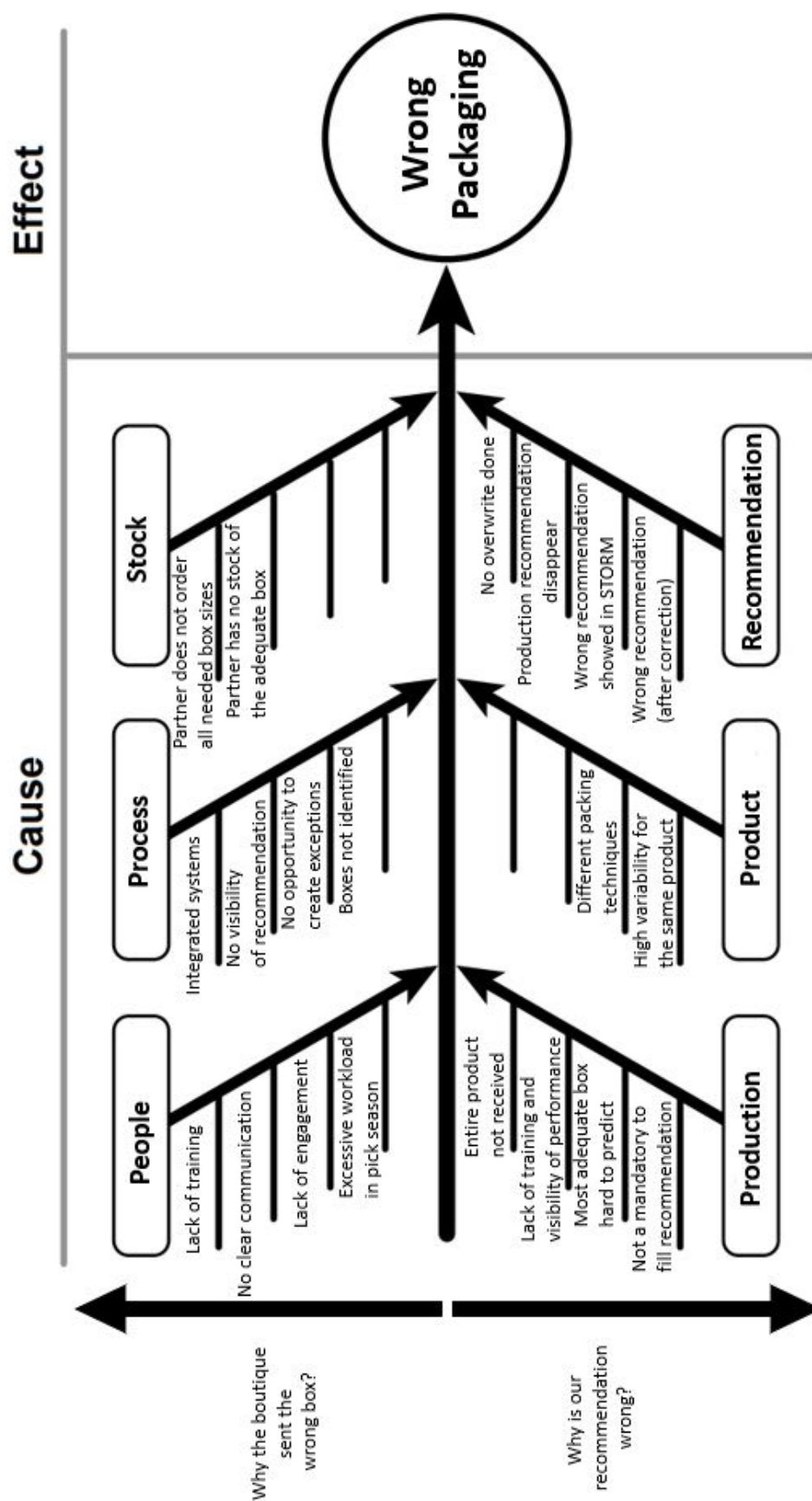



Figure D.7: Ishikawa Diagram with the different reasons for each cause

SCANOUT PROCESS

12121212 - Grecian-style dress

Store Number (SKU):		Price:	309 GBP
Descriptions:		Details:	



Product Information

<p>Season: * SS17</p> <p>Main Collection: * MAIN COLLECTION</p> <p>Brand: * ARMANI JEANS</p> <p>Designer ID: * PSA10DT</p> <p>Designer Colour: * 12</p> <p>Item Name (Friendly): Grecian-style dress</p> <p>Country of Origin: * India</p> <p>Washing Instructions: hand wash</p> <p>Gender: * WOMEN</p> <p>Category (First Level): * Clothing</p> <p>Category (Second Level): * Dresses</p> <p>Size Range: * Italy (CLOTHING WOMEN'S IT)</p> <p>Size Sent to Photography: * 36</p> <p>Main Colour: BLACK</p> <p>Secondary Colour: Select a secondary colour</p> <p>Colour Type: N/A</p> <p>Box: FF-1 Accessories (8 x 4.75 x 3.5)</p>	<p>Composition *</p> <p>Select a category Select a material</p> <p> % N/A Add</p> <p>Cotton (1064) 100% N/A Remove</p> <p>Designer Id Images</p> <p>View all (0)</p>
--	--

Save Partial Product Info Save Product Info

DDP Category:

DDP Sub-Category: FF-1 Accessories (8 x 4.75 x 3.5)

Construction: 13 - Boots (70x40x15)

Primary Composition: 14 - Large Box (60x45x25)

Figure D.8: Scanout Production Process

Appendix E

Define Stage of Packaging Project

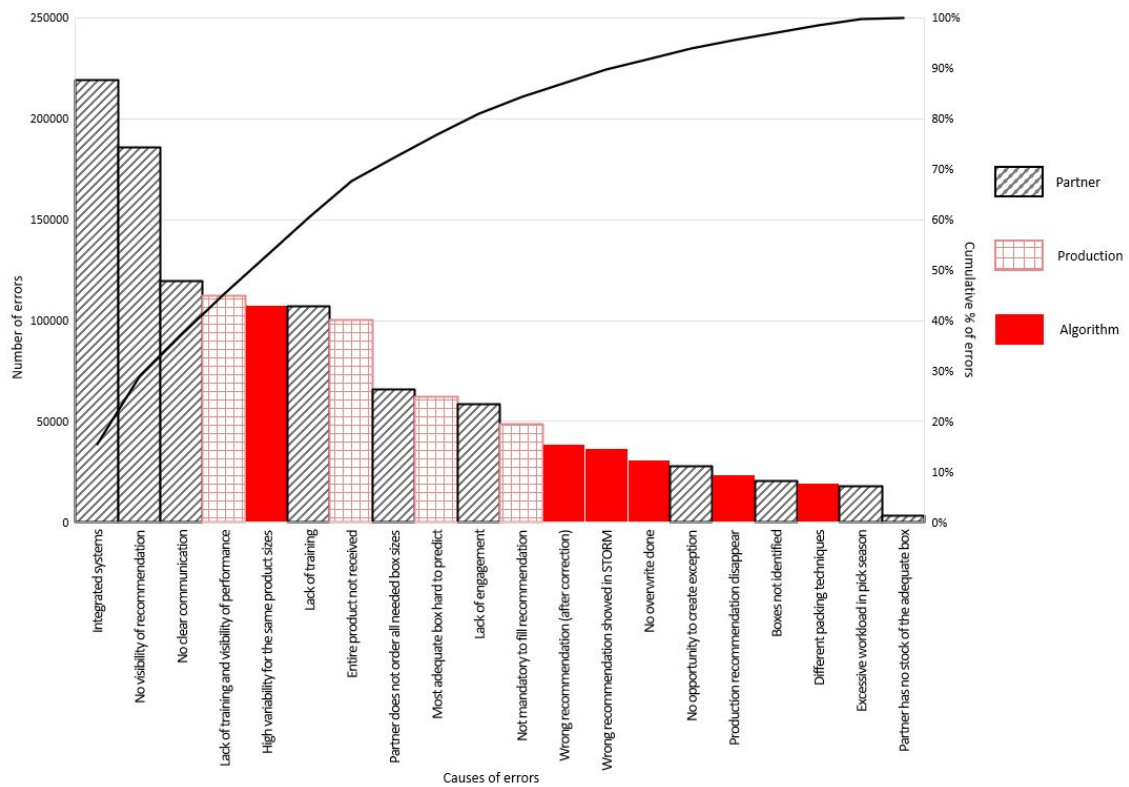


Figure E.1: Complete Pareto Chart

Appendix F

Deliver Stage of Packaging Project

Are stores using the recommended box?

Packaging Accuracy

Partner

_Correct bo...	01-2019	02-2019	03-2019	04-2019	05-2018	06-2018	07-2018	08-2018	09-2018	10-2018	11-2018	12-2018
No	25.70%	25.74%	25.60%	26.11%	24.16%	24.66%	25.00%	24.32%	24.17%	24.94%	25.57%	26.24%
Yes	74.30%	74.26%	74.40%	73.89%	75.84%	75.34%	75.00%	75.68%	75.83%	75.06%	74.43%	73.76%

		01-2019	02-2019	03-2019	04-2019	05-2018	06-2018	07-2018	08-2018	09-2018	10-2018	11-2018
No	No	25.7%	25.7%	25.6%	26.1%	24.2%	24.7%	25.0%	24.3%	24.2%	24.9%	25.6%
Yes	Exc	1.0%	0.7%	1.1%	1.4%	0.7%	0.8%	0.6%	0.8%	0.9%	0.9%	1.0%
	Yes	73.3%	73.5%	73.3%	72.5%	75.1%	74.5%	74.4%	74.9%	74.9%	74.2%	73.4%

Packaging Accuracy by Stock Point

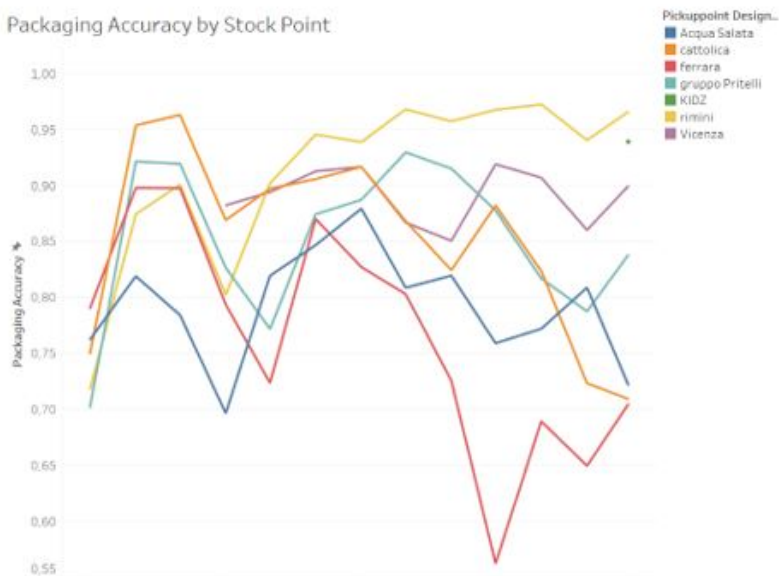
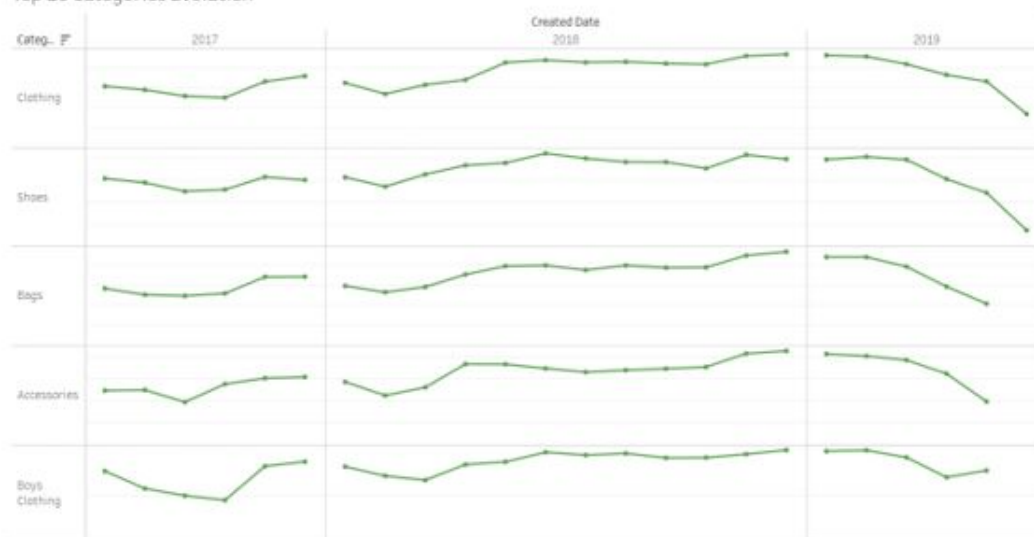


Figure F.1: Partner Dashboard extracts

Production

Top 10 Categories Evolution



Best Box vs Chosen Sales

Best Box	Production Box								
	Box 15	Box 16	Box 17	Box 3	Box 5	Box 6	Box 7	Box 13	Box 14
Box 15	86.01%	10.37%	2.41%	1.09%	0.07%	0.02%		0.01%	0.02%
Box 16	4.86%	91.25%	3.46%	0.20%	0.19%	0.02%	0.01%	0.00%	
Box 17	0.59%	1.63%	94.33%	1.16%	1.82%	0.34%	0.12%	0.01%	0.00%
Box 3	0.19%	0.04%	1.10%	96.67%	1.57%	0.32%	0.09%	0.01%	0.00%
Box 5	0.04%	0.03%	1.07%	8.25%	88.13%	2.01%	0.41%	0.06%	0.01%
Box 6	0.04%	0.04%	0.70%	2.29%	6.95%	87.94%	1.74%	0.15%	0.14%
Box 7	0.05%	0.07%	1.33%	0.58%	8.30%	10.12%	77.95%	0.92%	0.68%
Box 13		0.05%	0.64%	0.48%	2.78%	7.77%	4.08%	81.93%	2.28%
Box 14		0.36%		1.52%	4.70%	15.11%	9.12%	1.95%	67.24%
Null		2.48%	3.41%	19.03%	8.27%	10.53%	17.43%	18.01%	20.84%
Other			21.48%	11.85%	34.07%	24.44%	8.15%		

Figure F.2: Production Dashboard extracts